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WHITE'S

NEW COURSE IN ART INSTRUCTION

MANUAL

FOR

FOURTH YEAR

NEW YORK · CINCINNATI · CHICAGO

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WHITE'S NEW COURSE IN ART INSTRUCTION

MANUAL

FOR

FOURTH YEAR GRADE

INCLUDING

AN OUTLINE OF THE YEAR'S WORK

WITH SUGGESTIONS FOR TEACHING

NEW YORK ·:· CINCINNATI ·:· CHICAGO
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WHITE'S

NEW COURSE IN ART INSTRUCTION.

INTRODUCTORY.

WHITE'S NEW COURSE IN ART INSTRUCTION is not the result of one person's thought; nor was it, primarily, a commercial venture. It embodies the ideas of many, who, starting at widely separated points and working individually along different lines, arrived almost simultaneously at the same conclusions.

In some respects the course differs from all others. Its chief points of departure are as follows: —

I. **Its plan** is based on an analysis of the entire subject of Art Instruction, from which have been derived the divisions of the work and the outline of each division. These divisions are natural and not artificial, and are such as are justified by established usage.

II. **Its method** is determined by the laws of the mind, upon which depend all correct principles of teaching. For example:

(*a*) The object to be known must itself be present to the mind: hence, in this course models and objects take the place of pictures to be copied.

(*b*) The mind develops through its own activity: hence, no guide points or construction lines are given.

(*c*) In developing, the mind acts according to certain recognized laws: hence, the various departments of drawing are

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logically arranged, that the mind may pass naturally from one to another until the whole is known.

(*d*) While acting according to general laws, each mind has individual peculiarities which affect its growth: hence, while general principles are tenaciously adhered to, great freedom is allowed in the application and expression of these principles.

(*e*) The most rapid and substantial development of mind occurs under intelligent guidance: hence, illustrative material is given in abundance to guide the pupils in discovering principles, laws, conventional signs, styles of handling, etc.

III. **Its aims** are, first, to acquaint pupils with the rudiments of all kinds of drawing included under the two departments, mechanical and freehand, for the two are equally important, — one underlying all the industrial arts, and the other all the fine arts; therefore, provision is made for the related development of these two departments from the lowest grade throughout.

Secondly, to lead pupils to feel that, while art and love for the beautiful may be fostered by an artistic and beautiful environment, skill and power and quick original perception of beauty come only through faithful and persistent practice in drawing; for this reason correct proportions, accurate measurements, exact truthfulness in drawing are considered of chief importance, while pencil-holding, broadness and grayness of line, and suggestiveness are relegated to second place.

And, thirdly, to develop a love for the beautiful in nature and in art. By the comprehensive study of color and form, it leads to mineralogy and other natural sciences; through historic ornament, to mythology, ancient history, and historic art of all kinds; through plant-form, to botany and original design; through model and object drawing, to pictorial art; and through the different divisions of geometric drawing, to manual training and all the manifold constructive arts.

IV. **Its order of lessons** is therefore determined. The lessons follow a definite plan, are outlined according to a good method, and have certain ends in view. On this account their order

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should not be changed, unless the teacher can prove that such changes are in accordance with sound pedagogical principles.

The teacher of each grade should be familiar with the work of other grades, that the lessons may be progressive from grade to grade. The entire

GRAMMAR COURSE

is, therefore, here outlined to show the relation of the various divisions.

Pupils should enter the grammar grades with a knowledge of color, form, and arrangement, that their chief attention may be given to representation, or drawing.

Drawing may be Geometric, Decorative, or Pictorial in character, according to the class of facts represented. That drawing in which the actual form and structure of artificial objects are represented is *Geometric*. That in which the enrichment, or decoration, of artificial objects is represented, and that which represents units, or motives, of design, whether natural or artificial, is *Decorative*. That in which the forms of objects are represented as they appear from one point of view is *Pictorial*.

A thorough understanding of geometric drawing demands a knowledge of measurement, geometry, projection, and development. A just appreciation of decorative drawing requires some knowledge of color, historic ornament, plant form, and design; and, if the pupil is to apply his knowledge of color in design, facility in paper cutting is necessary. Accurate knowledge of pictorial art and appreciation of its artistic qualities are gained by a study of the principles underlying the representation of geometric solids, and the application of these principles in the representation of natural and manufactured objects.

The grammar course, therefore, includes a study of

Measurement,	Color,
Geometry,	Historic Ornament,
Working Drawing,	Botanical Drawing,
Development,	Design,

Paper Cutting,
Model and Object Drawing.

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OUTLINE OF A LOGICAL COURSE IN ART

GRADE OR YEAR IN SCHOOL	GEOMETRIC DRAWING.			
	MEASUREMENT.	GEOMETRY.	WORKING DRAWING.	DEVELOPMENT.
IV.	Use of Ruler. $\frac{1}{8}''$	Classification of Rectilinear Figs.	Representation of Curved Surfaces.	Equal Plane Faces at right angles.
V.	Use of Ruler. $\frac{1}{16}''$	Classification of Curvilinear and Mixtilinear Figs. (Instrumental.)	Representation of Curved and Plane Faces.	Unequal Plane Faces at right angles.
VI.	Drawing to Scale. Half size. Quarter size.	Simple Geometric Problems.	Representation of Invisible Parts. Plane Faces oblique in one view.	Plane and Curved Faces combined.
VII.	Drawing to Scale. $1\frac{1}{2}'' = 1'$	Construction of Polygons.	Plane Faces oblique in one and two views. Three views.	Plane Faces at oblique angles.
VIII.	Drawing to Scale. $\frac{3}{4}'' = 1'$	Inscribing and Circumscribing.	Plane Faces oblique in two or more views. Sections — parallel.	Radiating Flats.
IX.	Drawing to Scale. $\frac{1}{2}'' = 1'$ $\frac{1}{4}'' = 1'$	Advanced Problems. Tangents.	Sections — oblique. Intersections.	Truncated Radiating Flats.

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INSTRUCTION FOR GRAMMAR SCHOOLS.

DECORATIVE DRAWING.					PICTORIAL DRAWING.
COLOR.	HISTORIC ORNAMENT.	BOTANICAL DRAWING.	DESIGN.	PAPER CUTTING.	MODEL AND OBJECT DRAWING.
Classification by Values. Scales of Color. Dominant Harmony.	Modified Geometric Units.	Drawings of Seeds, Buds, Fruits.	Modification of Regular Geometric Units. Contrast. Unity. Strength.	Mixtilinear Forms.	*Effect of Distance and Level.* Representation of Solidity.
Classification by Values (cont.) Scales of Color. Dominant Harmony.	Modified Bilateral Units.	Leaves — entire-margined.	Modification of Bilateral Units. Variety. Rhythm. Repose.	Bilateral Forms.	*Foreshortening.* Effect of Level.
Classification by Composition. Simple and Binary Colors. Complementary Harmony.	Conventional Plant Forms on radial main lines.	Leaves — serrate, notched, and lobed. Flowers.	Growth. Strict Conventionalization of Plant Forms.	Radial Forms.	*Foreshortening Reviewed.* Concentric Circles. *Convergence.* *a.* One set of retreating edges bounding a vertical plane. *b.* One set of retreating edges bounding a horizontal plane.
Classification by Composition (cont.) Simple and Binary Colors. Analogous Harmony.	Conventional Plant Forms on bilateral main lines.	Compound Leaves.	Growth. Free Conventionalization of Plant Forms.	Radial Forms (cont.) Surface Patterns.	*Convergence (cont.)* Two sets of retreating edges. *a.* At equal angles. *b.* At unequal angles.
Classification by Qualities. Natural and Acquired. Analogous Harmony (cont.)	Conventional Ornament on bilateral main lines.	Sprays.	Growth. Conventionalization of Sprays.	Original Forms.	*Use of Diagonals.* *a.* To test work. *b.* To find centers.
Classification by Qualities (cont.) Effects of Juxtaposition. Perfected Harmony.	Conventional Ornament on balanced main lines.	Whole Plants.	Growth. Conventionalization of Plants.	Original Forms.	*Relation of Axes.* *a.* To entire mass of solid. — Ovoidal. *b.* To one face of solid. — Conical. *c.* To two faces of solid. — Cylindrical. *d.* To all edges of solid. — Pyramidal.

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The outline on pages 12 and 13 presents the entire grammar course in its simplest form.

Each vertical column shows the analysis of one of the ten divisions of representation. The Roman numerals at the left indicate the years of school life, and each horizontal line marks the program in drawing for that year. The drawing books are arranged in accordance with this plan.

The teacher should familiarize himself with this outline, and refer to it frequently, so that he may be able to teach better that part of it prescribed for any given grade.

A careful study of the foregoing tabulated outline will reveal the connection between subjects in each grade and their relations to those of other grades. For example: In the fourth year the use of the ruler in measuring accurately short distances like eighths of inches, helps to fix the lengths of dots in lines used in working drawings, and the widths of laps used in development. The solids not used in the classification of rectilinear figures and in development are used in working drawing or in model drawing. The rectilinear figures studied in geometry form the basis of the units used in historic ornament and design; and the type forms used in pictorial drawing are the basal forms of seeds, buds, and fruits studied under the head of botanical drawing. Again, the tendency of pupils in cutting mixtilinear forms to be used as units of design, is towards intricacy and elaboration; the simple forms of seed and fruit will tend to oppose this, and to create a love for simpler forms of exquisite curvature. Thus each subject supplements others in the grade. The study of each subject is logically pursued through the grades; for example, the analysis of the rectilinear figures studied in the fourth grade, and of the curvilinear figures in the fifth, leads to the discovery of simple geometric problems in the sixth, by the use of which polygons are constructed in the seventh year. These polygons, combined concentrically in the eighth year, furnish problems in inscribing and circumscribing; combined eccentrically in the ninth, they furnish problems in tangents.

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All the divisions are similarly outlined, and the lessons under each are arranged to lead the pupil step by step to the complete knowledge of the subject.

MATERIALS.

To secure the best results, each class should be supplied with the following materials: —

Models. White's drawing models, sets Nos. 2 and 3, prepared especially for this course.

Objects. As called for in the course. So far as possible, each pupil to furnish his own.

Drawing Books. White's New Course in Art Instruction, one number each year.

No. 4, for fourth year in school.
No. 5, for fifth year in school.
No. 6, for sixth year in school.
No. 7, for seventh year in school.
No. 8, for eighth year in school.
No. 9, for ninth year in school.

Drawing Paper. Good quality, sheets 9″ × 12″. That manufactured by the American Book Company is preferable.

Development Paper. "Oak tag" of medium weight, in sheets 9″ × 12″.

Colored Papers. White's educational colored papers are required to complete the work in color, as outlined in this course.

Package No. 4, for fourth year.
Package No. 5, for fifth year.
Package No. 6, for sixth year.
Package No. 7, for seventh, eighth, and ninth years.

Tracing Paper. Tissue paper of good quality will do, although the tracing paper used by designers is preferable. One sheet, 9″ × 12″, will be required by each pupil every year.

Pencils. These should be of good quality and medium hardness.

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Erasers. Flexible, elastic erasers are the best.

Rulers or Scales. For the fourth and fifth years, Bradley's industrial drawing scales are recommended. For the sixth, seventh, eighth, and ninth years, Bradley's drawing scales, or architects' triangular scales, will be found most satisfactory.

Compasses. White's patent drawing compasses, with pencil.

Scissors. If possible, each pupil should have a pair of sharp four or five-inch, steel scissors of fair quality.

Glue. Each pupil should have a bottle of liquid glue, for constructing designs and objects from developments.

Each pupil should be held responsible for the condition of his own materials.

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OUTLINE OF FOURTH YEAR'S WORK.

(First Grammar Year. — Drawing Book IV.)

Note. — A compact outline of the year's work is first presented, in which only essential directions and references to pages and figures in the drawing book are given, to make clear what is required. Detailed directions and suggestions are added under another heading.

1. GEOMETRIC DRAWING.

I. MEASUREMENT.

Preliminary work:

Drill in use of ruler; review 1″, 2″, 3″, etc., $\frac{1}{2}$″, $\frac{1}{4}$″; teach $\frac{1}{8}$″; give practice in measuring and judging distances.

All this work to be taken in connection with the other lessons in Geometric Drawing. (See page 24.)

II. GEOMETRY. Draw accurately with ruler.

Preliminary work:

Review Geometric Figures and their details, as outlined on page 22.

Practice drawing lessons for page 3 on manilla paper.

Page 3. Geometric Figures.

a. Draw margin lines $\frac{3}{4}$″ from the edges of page.

b. Divide the space into six equal parts, nearly square.

1. Draw a figure bounded by the fewest straight lines possible; in it write its name.
2. Draw a triangle having two sides equal; base, $2\frac{3}{8}$″; altitude, $2\frac{3}{8}$″; in it write its name.
3. Draw an equilateral triangle on a $2\frac{3}{8}$″ base; divide it into two equal similar parts. In how many ways may it be so divided?
4. Draw a $2\frac{1}{8}$″ square; in it draw diameters and diagonals, very lightly.
5. Draw a rectangle or oblong, one side $2\frac{3}{8}$″; in it draw lightly the diameters and diagonals. Compare with square.
6. Draw a rhombus; one side, $1\frac{7}{8}$″.

Page 4. Applications.

a. Draw margin lines. (Unless otherwise specified the margin lines should always be $\frac{3}{4}$″ from the edges of the pages.)

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b. Divide the space into halves, by a vertical line.
1. Draw some object based on a triangle or a square.
2. Draw some object based on an oblong or a rhombus.

III. WORKING DRAWING. Draw accurately with ruler and compasses.

Preliminary work:

Review the solids; teach *view; front view; top view;* and *working drawing.* (See page 30 and Illus. Def. beginning page 97.)

Teach use of lines:

Full lines represent visible outlines and edges.

Dotted, or *working lines,* connect different views.

Make freehand sketches of the models and objects, either upon practice paper or blackboard. When principles are understood, draw accurately in the book.

Page 7. Principle: The representation of visible outlines.

a. Draw margin lines.
b. Divide the space into halves by a vertical line.
1. Draw two views of a sphere.
2. Draw two views of an ovoid.

Page 8. Applications.

a. Draw margin lines.
b. Divide the space into halves by a vertical line.
1. Draw two views of a spherical object; *e.g.*, ball, gas globe, dumb-bell, rattle, sponge glass, sleigh bell, Japanese basket.
2. Draw two views of an ovoidal object; *e.g.*, mending ball, rose jar, sugar shaker, salt shaker, or incandescent light bulb.

IV. DEVELOPMENT.

Preliminary work:

Make freehand sketches of the flats of all solids illustrating the conditions under consideration, either upon practice paper, blackboard, or both. Then draw accurately in the book. (See page 35.)

Page 9. Condition: Equal plane faces at right angles.

a. Draw margin lines.
1. Develop the surface of a cube.
2. Indicate positions of laps.
3. Draw the flat on development paper; construct.

Page 10. Application.

a. Draw margin lines.
1. Develop the flat of a cubical basket, or of a cubical box.
2. Indicate laps.
3. Draw the flat on development paper; construct: reserve for ornamentation later.

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2. DECORATIVE DRAWING.

V. BOTANICAL DRAWING.

Preliminary work:

Make collections of seeds, buds, and fruits, including pods; study them; sketch on practice paper and blackboard; use this material for language lessons. (See page 44.)

Page 11. Seeds, Buds, Fruits.

a. Draw margin lines.

b. Divide the space by diameters into four equal spaces.

1. Draw a kernel of corn, a bean, or a squash or pumpkin seed, enlarged.
2. Draw a pod.
3. Draw a sprouting pea.
4. Draw a sprouting bean, corn, or seed of any kind.

Page 12. (Optional, or for color.)

VI. COLOR.

Preliminary work:

Review the primary course in color. Be sure that the pupils can recognize at once and name the six standards and the thirteen hues.

Teach *classification by values*: scales of color, tones; tints, keytones, shades. Give practice in selecting and matching tones. Teach *dominant harmony.* (See page 39.)

Page 12.

Arrange colored papers to illustrate scales of color, and dominant harmony.

VII. HISTORIC ORNAMENT.

Preliminary work:

Review arrangements: border, center, surface, unit.

Teach *modification of units:* (*a*) by cutting paper; (*b*) by drawing on blackboard; (*c*) by studying Book IV., pages 14 and 19. (See page 48.)

Page 15. Modified Regular Units.

a. Draw margin lines.

b. Divide the space into two equal parts by a vertical line.

1. Draw Fig. 4, enlarged to twice its present size.
2. Draw Fig. 9, 10, 11, or 12, enlarged to properly fill the space. Erase guide lines; finish with a soft gray line.

Page 16.

a. Draw margin lines.

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b. Divide the space into two equal parts by a vertical line.

c. Fold the leaf so that the first half of page 16 is visible when the book is open to page 14, (or draw upon practice paper first).

1. Draw Fig. 1, 2, 3, 5, or 6.
2. Select a pleasing color, cut the unit drawn, and mount it upon the right half of page 16. (See page 49.)

Page 17.

Upon this page construct a border or surface, using the selected historic unit. Let the design illustrate dominant harmony; that is, use a tint, standard, and shade of one color. Plan the page so that when finished it will be pleasing in arrangement and good in color.

VIII. DESIGN.

Preliminary work:

Review work preliminary to historic ornament.

Teach *principles of design;* contrast, unity, strength: (*a*) by cutting paper; (*b*) by drawing; (*c*) by studying Book IV., pages 14 and 19. (See page 52.)

Page 18. Original Units.

a. Draw margin lines.

b. Divide the space into two equal parts by a vertical line.

1. Draw an original modified unit based on the square.
2. Draw an original modified unit based on some other regular geometric figure.
3. Cut one or more of these, and apply to paper box constructed in a previous lesson.

Page 21. Design from Copy.

Upon this page copy one design given on page 20. Enlarge to properly fill the page. Lay out the design accurately with a ruler. Use tracing paper to transfer units, after the first is rightly drawn. Finish with clean gray lines; half-tinting to be *very* light.

NOTE. — Half-tint, lightly, a part of each design given on page 20. The ground in 28, 29, and 31; the units in 30; the ground in 32. Why not half-tint the units in 32? In 31? What would be the effect?

Page 22. Original Design.

a. Select colors for constructing a design in dominant harmony.

b. Draw a pattern for the unit of design, from one of the original units previously drawn on page 18.

c. Cut units of colored paper.

1. Lay out page 22 for a border or surface, in good proportion, accurately spaced.
2. Construct the design.

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IX. PAPER CUTTING.

(See Notes on Paper Cutting, pages 61–66.)

3. PICTORIAL DRAWING.

X. MODEL AND OBJECT DRAWING.

To be entirely freehand.

Preliminary work:

Review solids; working drawing. Teach what is meant by pictorial drawing. (See page 67.)

Practice seeing with one eye; seeing masses; using wire to touch (apparently) points on distant objects.

Teach *effect of distance.* (Distance decreases the apparent size of objects.) Teach the *representation of solidity.*

Have pupils make sketches of sphere and similar forms.

Page 23. Representation of Solidity.

a. Draw margin lines.

1. Draw the picture of a sphere standing upon a plane surface, the drawing to be at least 4 inches in diameter. Indicate the highest point on sphere.

Page 24.

a. Draw margin lines.

1. Draw a spheroid or ovoid, standing upon a plane surface. Draw of such a size that the pages will balance well.

Page 25. Application.

a. Draw margin lines.

1. Draw some object based on the sphere; *e.g.*, an apple, orange, ball, peach, or yellow tomato.

Page 26.

a. Draw margin line.

1. Draw some object based on an ovoid; *e.g.*, a plum, pear, pepper, gourd, etc.

NOTE. — Try to make the pencil line express the character of the surface of the object represented. Study the illustrations to see how this may be done.

Page 29. Group.

Teach what is meant by *grouping;* make groups, using various objects in the room. Teach what is meant by *principal* and *accessory.* (See page 72.)

a. Draw margin lines.

1. Draw a simple group of fruit similar to the groups illustrated on page 28.

Page 30. Group.

Make an original group of simple objects and draw it on this page.

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1. GEOMETRIC DRAWING.

Geometric Drawing deals with the actual form and structure of objects. It includes *Measurement*, to determine and represent size and proportion; *Geometry*, to determine and represent underlying structure and relation; *Working Drawing*, to represent solid form; and *Development*, to obtain superficial area.

Geometric Drawing should be accurate. Mechanical aids — the ruler and compasses — are indispensable. The last results, however, may be obtained only when Geometric Drawing is preceded by a careful study of solid forms, and freehand representation of their planes: hence, the first work in the fourth year grade should be a review of form.

General Review of the Study of Form.

A. — Solids.

1. Curvilinear { Sphere. / Spheroids { Flat. / Long. } / Ovoid. }

2. Mixtilinear { Hemisphere. / Cylinder. / Half-cylinder. / Circular Plinth. / Cone. }

3. Rectilinear { Cube. / Prisms . . . . { Triangular. / Square. } / Square Plinth. / Square Pyramid. }

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B. — Geometric Figures. *Represent plane faces.*

1. Curvilinear { Circle, Ellipse, Oval } { Circumference. Arc. Center; foci. Diameter. Axis. Radius.

2. Mixtilinear { Semicircle. Quadrant.

3. Rectilinear { Triangles { Base. Altitude. Apex. Scalene (right-angled), Isosceles, Equilateral. Quadrangles { Diagonal. Diameter. Square, Oblong, Rhombus, Rhomboid.

C. — Lines. *Represent outlines or edges.*

1. Lines { Curved { Circular. Elliptical. Oval. Straight.

2. Position { Horizontal. Vertical. Oblique.

3. Relation { Parallel. At an angle { Right = perpendicular. Oblique { Acute. Obtuse.

D. — Points. *Represent corners; mark positions.*

This last work leads directly to measurement, where the exact distances between corners and points are determined by using a ruler.

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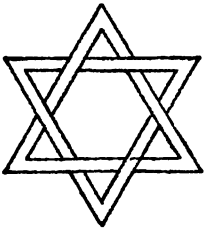
MEASUREMENT.

The Ruler should be of hard wood, with a straight sharp edge, one foot in length, and accurately divided into inches, halves, quarters, eighths, and sixteenths. Pencil marks should never be made upon the ruler, nor should its edge be cut or nicked.

Measuring. — Measure accurately. Do not depend upon the figures on the ruler: become familiar with the divisions, so that measurements may be read either way regardless of the figures. When determining short distances do *not* measure from the extreme end of the ruler, — begin at some prominent division. The divisions near the extreme ends are often inaccurate.

Pupils will need a large amount of practice to enable them to measure accurately and rapidly such simple objects as a sheet of paper, a book cover, the desk top, the slate, a pane of glass, etc.

After the first few exercises all measurement should be in connection with Geometry, Working Drawing, Development, and other divisions of the course.



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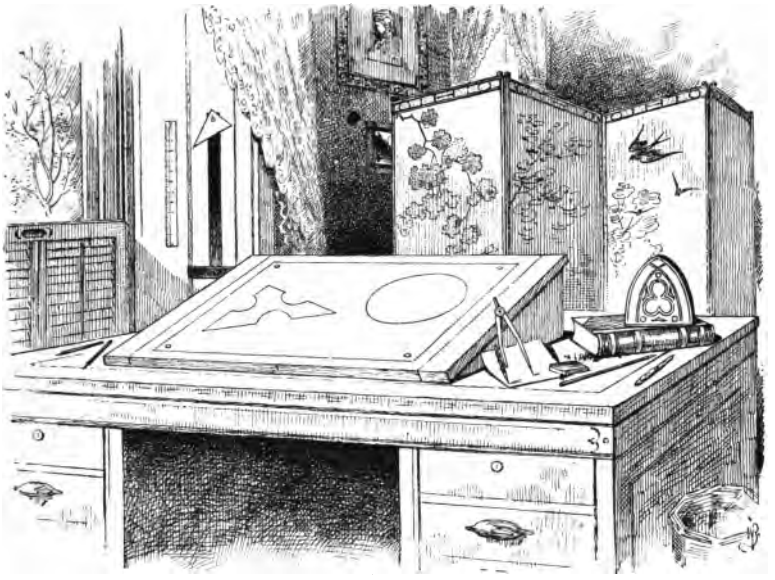

GEOMETRY.

Geometry begins with the study of the type solids, — sphere, cylinder, cube, — their divisions, and variations, in the primary grades, and the first exercises in the grammar grades should be review of the primary lessons. (See page 22.)

MATERIALS.

The materials should be of good quality. Good results are seldom obtained with poor tools.

The materials should be distributed in good condition before the lesson, should be handled carefully by the pupils, and returned in as good condition as when distributed. At first, reliable pupils chosen by the teacher may have charge of the materials; but as the members of the class gain self-reliance, each should be held responsible for his own tools, like any other good workman.

Paper. — The paper should not be too rough. Smooth paper is best for first practice, for it does not so rapidly wear away the lead compass point. Thick, firm paper is preferable, for it is not easily punctured and torn by the steel compass point.

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Pencil. — For geometric drawing the best pencil is rather hard, — a No. 3, or an H. It should have a smooth conical point for general work; but for Geometry, it should have a chisel point, made by sharpening a blunt conical point on two opposite sides only. This pencil should be reserved for geometric drawing.

Ruler and Ruling. — The ruler should have a straight, sharp, thin edge. The points between which a line is to be ruled should not be covered by the ruler, but a little allowance should be made for the thickness of the pencil point. The ruler should be placed so that the light may shine upon the edge against which the line is to be ruled. The pencil should be held nearly upright, and the line drawn from left to right.

Compasses. — The compasses should have a sharp needle point, and a rigid lead point sharpened on two sides only, — that next the needle point when the legs are near together, called the inner side, and that opposite this, called the outer side of the lead. The compasses should be held between the thumb and first finger, at the end above the hinge; and, in describing arcs, they may be turned either to the left or right as convenient. No hole should be visible at the center of a circle or arc; if one appears, smooth the paper from the back with the thumb-nail.

METHODS.

"Whatever knowledge is taught a child should be so taught that the act of acquiring it shall be of greater value than the knowledge itself."

— Dr. E. E. White.

Preparation. — All exercises of a lesson should be previously drawn by the teacher. They may be drawn upon charts or on the blackboard to assist in presenting or explaining the lesson. Such drawings are not to be copied by the pupils, but used as references only. From White's drawing models, set No. 2, select all those having faces of the shape to be studied. Compare these with the illustrations of geometric figures in Book IV., page 5. Know every step to be taken, and be prepared to illustrate each by rapid sketches upon the blackboard.

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Lessons. — Steps to be taken by pupils: —

(*a*) Review the type solids, and select those having faces shaped like the geometric figures to be studied.
(*b*) Compare these with the illustrations in Book IV., page 5.
(*c*) Discuss the different varieties and typical positions of triangles and quadrilaterals.
(*d*) Sketch the figures quickly upon the blackboard or on practice paper.
(*e*) Sketch their details, — altitude, diameter, diagonal, etc.
(*f*) Name several objects based on each figure.
(*g*) Practice, preparatory to drawing in the book.
(*h*) Draw in the book as directed. (See page 17.)

☞ **"Make haste slowly." Exact attention, and then give each direction distinctly. Make sure that it is understood, but avoid repetition. Allow no one to work during an explanation. Give pupils sufficient time to perform each process correctly. By proceeding slowly, excellent and uniform class work may be procured and discouraging errors avoided.**

Results. — A completed page of geometric drawing should have clean, dark margin lines, forming accurate corners; large, well-proportioned drawings placed symmetrically in the allotted spaces; and no finger marks or partially erased lines. Whenever possible, the pupil should be required to invent processes, and to produce original results. Objects based upon geometric figures are to be drawn freehand, except when other objects are to be constructed from the drawings.

One result to be obtained is the *habit* of drawing objects according to a good method, namely: —

(*a*) Determine proportions, and indicate width and height with soft gray lines.

(*b*) Sketch, or block-in, the general contour or mass of the object.

(*c*) Determine proportions of subordinate parts, and sketch the parts.

(*d*) Make corrections, if necessary, and erase all construction lines and errors; add only such details as especially help to identify the object, and finish with lines indicative of its character.

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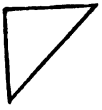
ILLUSTRATIONS.

Rectilinear Plane Figures (Drawing Book IV., page 5).



1. A right-angled triangle.

2. An isosceles triangle.

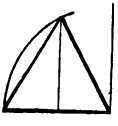
3. An obtuse-angled triangle.

4. An equilateral triangle.

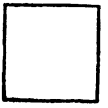
5. An isosceles triangle.

6. A scalene triangle.

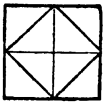
7. A rhombus.



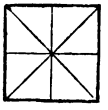
8. An equilateral triangle, showing construction lines.



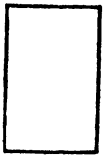
14. A square.



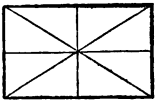
15. A square with diameters and an inner square "on its diagonals."



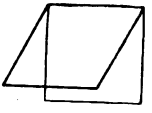
16. A square with diameters and diagonals.



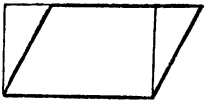
17. An oblong or rectangle.



19. An oblong with diameters and diagonals.



21. A rhombus developed from a square.



22. A rhomboid developed from an oblong.

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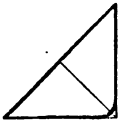
Applications (Drawing Book IV., page 5).

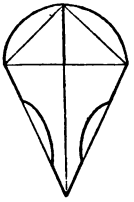
NOTE. — Objects 9 and 9*a*, 12, 13, 23, and 24 may be constructed by the pupil from cardboard or wood; 10, from "oak tag"; 18 and 26, from blank paper, as exercises in manual training, to show the practical application of geometric figures in useful articles.

9. A triangular bracket.

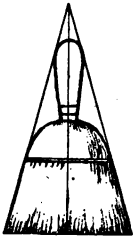


9*a*. A triangular shelf.

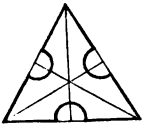
(9 and 9*a*, the two parts of a corner bracket.)



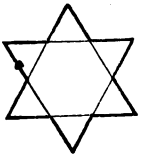
10. Another form of corner bracket, the shelf having two supports instead of one.



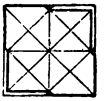
11. A whisk broom, triangular in shape.



12. A triangular silk reel.

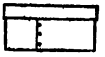


13. A reel based on two equilateral triangles.

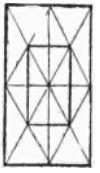


18. The flat of a square envelope.

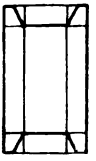
18*a*. One view of the square envelope.



20. The side view of a dry measure.

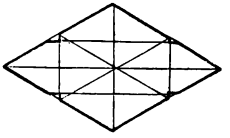


23. An oblong picture frame with construction lines.



24. An oblong reel with construction lines.

25. One view of an oblong envelope.



26. The flat of an oblong envelope.

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WORKING DRAWING.

Working drawings are made to guide workmen in accurately constructing such objects as tools and other utensils, machines, houses, ships, etc. They should give all needed information in regard to size, shape, and relation of the parts of the object to be made.

Views. — Solid objects have three dimensions — length, width, and thickness. All these cannot be seen their actual size from any one point of view; and as working drawings must give actual facts of form, more than one drawing of the object must be made. These drawings commonly represent two views of the object. For example, in Book IV., page 6, Figure 7, two views of a door knob are given. The circle represents a front view of the knob, such as would be seen by a child approaching the closed door; the drawing at the right of the circle represents a side view, showing how much the knob projects from the door.

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Number of Views. — Some objects are so intricate that all their parts cannot be represented to advantage in two views. In such cases, three or more views are represented. But ordinarily a top view, a front view, and a side view suffice.

Position of Views. — The different views are grouped as convenient upon one sheet, or drawn upon different sheets. In either case, to avoid mistake, the different views are often lettered, "front view," "top view," "side view," "end view," etc., as the case may be.

In simple drawings like those required of pupils the front view is often drawn first, and the top view placed above it, or the bottom view below it; or the view of the left side at the left, or the view of the right side at the right, of the first drawing. Another method often used in machine drafting rooms is to place the views according to the principles of orthographic projection. This brings the top view below the front view, and the bottom view above it, — just the reverse of the first arrangement. Practically, it makes no difference how the views are placed, so long as there is no danger of confusion.

Conventional Lines. — Various kinds of lines are used with definite significance in working drawings: —

———————— *Full, clear, dark lines* are used to represent visible parts.

— — — — — — *Dashed lines* are used to represent invisible parts.

---------- *Finely dotted lines* are used to connect different views.

— · — · — · — · *Dot-and-dash lines* indicate center lines or axes of objects. These are drawn only when necessary to locate accurately the centers of cylindrical, conical, or spheroidal objects.

←————1″————→ *Very fine continuous lines, with arrow points and figures,* indicate dimensions.

NOTE. — In the early study of working drawing it will be found best to use only two kinds of lines: *full lines* for the finished outlines of the object, and *finely dotted lines* for connectives. Center and construction lines may be sketched very lightly, if necessary, and erased before finishing the drawing.

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MATERIALS.

Paper should be of two kinds, — a cheap manilla paper for making preparatory sketches, and a granulated paper of good quality, like that in the drawing books.

Pencil, Ruler, Compasses, same as for Geometry.

METHODS.

Preparation. — Compare the drawings in Book IV., page 6, with the objects which they represent, and understand the meaning of each line.

Carefully plan and draw all sheets or pages of working drawing before attempting to teach the class. This is of utmost importance. The views should be grouped symmetrically in the allotted space, not crowded nor detached; this means thoughtful planning before the lesson is given to the class. Make a freehand sketch from the object to be drawn, and mark the dimensions on the sketch. Make the finished drawing from the sketch.

Lessons. — Steps to be taken by the pupil: —

(*a*) Compare the type solids with their representations in Book IV., page 6. Know what each line represents.

(*b*) Sketch quickly upon the blackboard, or on practice paper, two views of the spheroidal solids.

(*c*) Name several objects similar to the type solids studied.

(*d*) Sketch upon the blackboard, or on practice paper, two views of some simple spheroidal object.

(*e*) Make the required drawings in the book. (See page 18.)

NOTE. — The drawings should always be made from the object, and the different parts of the drawing should be spoken of as *views* of the object. The expressions *plan* and *elevation* may be used later.

For applications, select simple objects that illustrate the principle and may be drawn full size. Select for representation those views which are most characteristic of the object. (*a*) Make a freehand sketch of the object from each selected point

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of view; (*b*) mark the dimensions; (*c*) plan the final drawing; (*d*) represent the principal parts first; (*e*) add all important detail; (*f*) correct, if necessary, and erase errors; (*g*) line-in with clear, sharp lines; (*h*) add delicate dimension lines and neat, unobtrusive figures.

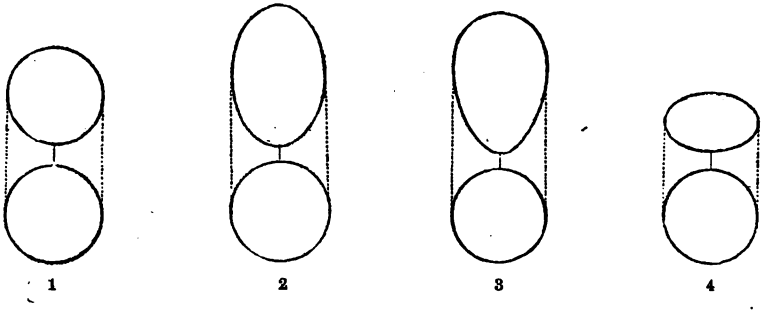
Results. — A clean, well-arranged page, accurately drawn and neatly lettered, is the ideal.

The lines representing the object should be of uniform strength throughout, and much heavier than all other lines used, so that they shall stand out in clear relief from them.

In more advanced complicated drawings, the lines are sometimes varied in strength to indicate conventionally the relief of the parts.

ILLUSTRATIONS.

Spherical and Spheroidal Solids (Drawing Book IV., page 6).



1. *A sphere.* — The lower circle represents a front view, and the upper, a top view. The dotted lines, tangential to the circles, show that the circles represent two views of one object.
2. *An ellipsoid.* — The object is represented with an end towards the spectator; front view a circle, top view an ellipse.
3. *An ovoid.*
4. *A flat spheroid.*

NOTE. — Spherical and spheroidal solids may be drawn as follows: (*a*) sketch lightly a vertical center line; (*b*) divide it into two parts proportional to the amount of space required by each view, allowing a little space between the two views; (*c*) indicate the exact width and height of each view, remembering that

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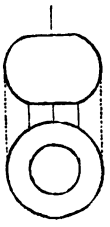
the widths are *always* alike in the two views; (*d*) sketch the views; (*e*) erase central and other guide lines; (*f*) line-in, and add the connecting lines tangent to the outlines.

Applications (Drawing Book IV., page 6).



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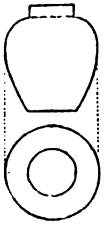


6

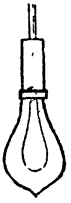
5. *A Japanese basket*, shaped like a flat spheroid. Another arrangement of views is here shown. The upper drawing is a front view as the basket stands on a table or desk; the lower drawing is the top view or plan. The inner circle in the plan represents the rim of the opening in the top of the basket.

6. *A rose jar*, ovoidal in form. The inner circle in plan represents the cover.

7. *A door knob*, shaped like a flat spheroid.

7

8



9

8. *A dumb-bell.* — Only one view is given; the other view would be a circle.

9. *An electric light bulb.* — Only one view is given; the other would be circular.

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DEVELOPMENT.

Developments, or patterns, are made for the construction of such objects as leather bags, shoes, boots, slippers, gloves, pocket-books, cardcases, tin kitchen utensils, copper finials, ventilating ducts, and all other objects made of cloth, leather, paper, or sheet metal, which it is necessary to cut by pattern.

A development shows the entire surface of the object laid out in one plane, the different faces being of their actual shape and size, and so arranged that when folded the object may be exactly covered by the development, or its form reproduced.

MATERIALS.

Paper. — Use practice paper for the first freehand sketches, but the final drawing should be made on "oak tag," or paper of similar quality, — stiff, thick, tough, with a smooth surface.

Pencil, Ruler, Compasses, same as for Geometry.

Scissors, or a sharp-pointed knife, will be required to cut the development.

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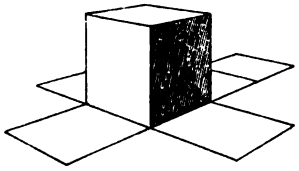
Glue. — A liquid glue, or paste equally adhesive, should be used. Common, cheap mucilage is not satisfactory.

METHODS.

Preparation. — If possible, obtain a 4″ cube (White's Drawing Models, set No. 3), place it upon a large, smooth sheet of stiff manilla paper, and trace around one face. The square thus produced represents one face of the cube, and is one section of the development, or pattern, shown in Drawing Book IV., page 6, Figure 1. The development is in the form of a Latin cross. Let this first square be the central one, at the intersection of the arms. By turning the cube over towards the left, its left-hand face may be traced; replacing, and turning it over toward the right, its right-hand face may be traced. Trace the other faces in a similar way. Draw the laps (about $\frac{1}{2}$″ wide in a 4″ cube) indicated by the light lines in Figure 1. Cut out the development and fold it around the cube, to be sure that it fits. Do not glue it until after the class lesson on drawing it.



Lessons. — Steps to be taken by the pupil: —

(*a*) *Trace the Development from the Model.* — Place the model, a wooden cube of 2″ side, on the paper, and trace one of its square faces, keeping the pencil close to the edges of the cube. This is to be repeated for each of the other faces, tracing four in one direction, and the remaining two, one above and one below the second square.

(*b*) *Draw the Development Freehand.* — Draw a horizontal line of about four times the length of the side of the cube; on it mark off the four lengths for the sides in one direction. Mark the points of division 1, 2, and 3. Through the points 1 and 2 draw vertical lines, the length of three sides of the cube, allowing two parts above the horizontal line and one part below. Draw a second horizontal line above the first, and at a distance from it equal to one side of the square.

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One square face is thus obtained. Complete the square to the left of this by drawing a vertical line; the two squares to the right by two vertical lines; and those above and below by two horizontal lines.

(*c*) *Draw the Development Mechanically.* — Proceed as in freehand drawing; but measure and rule each line accurately and precisely.

(*d*) Cut out the development. Go over lines representing edges with a pin or lightly with the point of a knife, to insure sharp edges when folded. *Fold with the lines on the outside.*

(*e*) Glue the cube into shape.

(*f*) Make the required drawing in the book. (See page 18.)

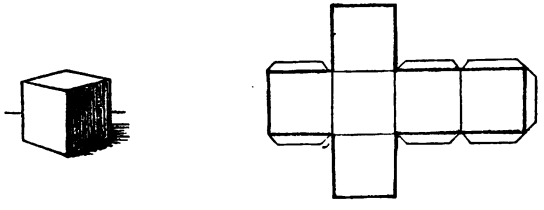
NOTE. — When drawing the developments of objects based on the type solid, step *a* is to be omitted, and such other changes and modifications as the character of the object may require can be made without changing the general order.

Results. — Drawings of developments must be accurate, otherwise the parts will not fold together perfectly. The lines representing edges should be sharp and dark and of uniform strength; those representing the laps should be lighter. Objects constructed from developments should be neat and accurate. These results can hardly be produced with poor material.

Encourage the pupils to make original applications or original modifications of selected objects, and original ornamentation of constructed objects.

ILLUSTRATIONS.

Cubical Solids (Drawing Book IV., page 6).



1

1. *A cube.* — Four sides arranged horizontally; top face above and bottom face below the second side; laps on sides only.

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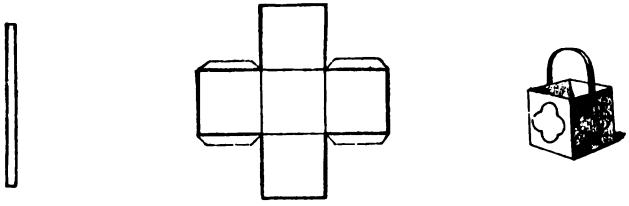
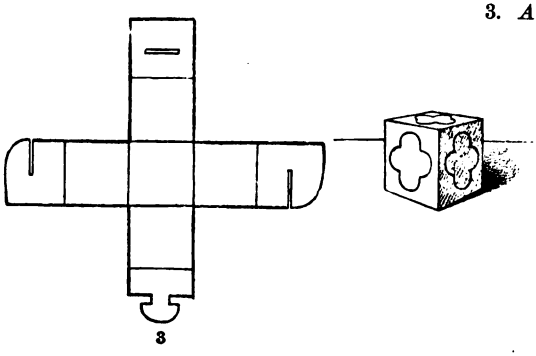
Applications.



2

2. *A cubical basket.* — Bottom and four sides joined to be cut in one piece; handle, a long, narrow strip, to be added. In the perspective sketch the sides are represented as oranamented with quatrefoils of colored paper.



3

3. *A cubical box.* — Development of nine squares, of which the end ones are so modified that they serve to securely close the box. The modifications may be easily imitated, or others devised to serve the same purpose. (Compare with other millinery and confectionery boxes.) To make this development serviceable, broad laps should be added, as in Figure 2. In the perspective sketch, ornamented sides are represented.

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2. DECORATIVE DRAWING.

Decorative Drawing, as a subject, includes the study of those elements which inspire, guide, and enrich ornamental designs. The designer finds inspiration and suggestion in *Plant Form*, ideal types and guiding laws in *Historic Ornament* and its derived principles of *Design*, and appropriate enrichment for his drawings in *Color*.

Decorative Drawing, as drawing, should be beautiful. Everything which aids in producing an ideal result is therefore legitimate — ruler, compasses, tracing paper, anything — in its proper place.

COLOR.

Color is taken first, that pupils may be prepared to observe and study it throughout the course in Decorative Drawing.

The work of this grade presupposes a knowledge of the spectrum and its different selected tones, and the ability on the part of the pupils to recognize, match, and name at least eighteen tones (namely, these arranged in a column), and to give them in order, beginning at the top.

Violet-red.
Red.
Orange-red.
Red-orange.
Orange.
Yellow-orange.
Orange-yellow.
Yellow.
Green-yellow.
Yellow-green.
Green.
Blue-green.
Green-blue.
Blue.
Violet-blue.
Blue-violet.
Violet.
Red-violet.

Scales of Color. — Observation will reveal the fact that these colors do not appear the same under different conditions. *The value*

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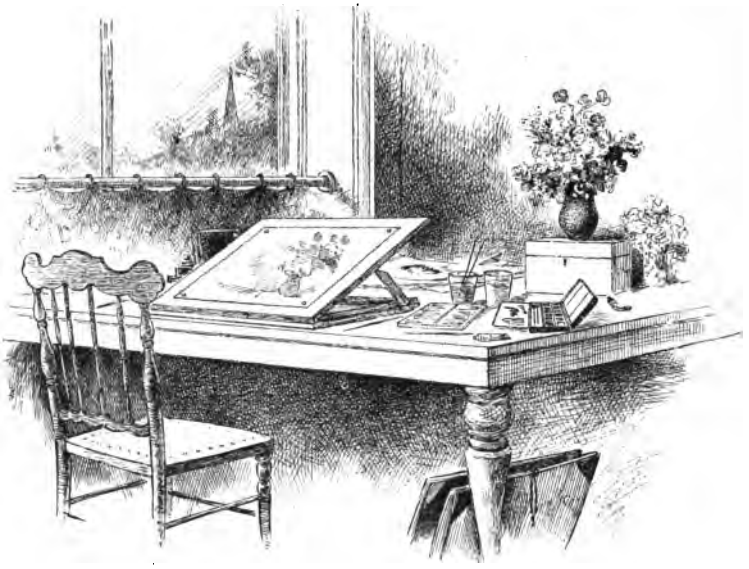

of a color changes as its illumination changes. For example: Under intense light, red will appear pink; under feeble light, a deep, rich brown. These variations of a color under different degrees of illumination are called its *tones.* These tones, when properly placed, produce a *scale of color.* Each standard and each hue is the central or *key tone* in a color scale, whose tones range from white to black. Five of these tones are to be seen in the selected scales used in this grade. All tones which contain white are *tints;* all which contain black are *shades.* For example: —

Red Tint No. 2.	Red Tint No. 1.	Standard *Red.*	Red Shade No. 1.	Red Shade No. 2.

Tints and shades may be illustrated by means of the color wheel and disks. By rotating a red and white disk together, tints may be produced; red and black disks will give shades.

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Harmonies of Color. — When color tones are grouped so that they produce an effect pleasing to a cultivated color sense, they produce a harmony. Different groupings of tones produce different harmonies. One of the simplest groupings of tones produces a dominant harmony.

Dominant Harmony. — This harmony is produced by grouping *tones from one color scale.* For example, a tint, the key-tone, and a shade of violet would produce a dominant harmony in violet. Any tones in the scale may be combined, according to the taste of the designer: —

A tint, the key-tone, a shade.
Two tints and the key-tone.
Two shades and the key-tone.
Two tints and a shade.
Two shades and a tint.
A tint and a shade.
A tint and the key-tone.
A shade and the key-tone.

MATERIALS.

The materials for color work must be carefully protected from light, except when in actual use, and should be handled delicately, so that no finger marks or wrinkles disfigure the colored surfaces.

Tablets. — The teacher and each pupil should be supplied with the set of color tablets prepared, by the authors of this course, for use in the fourth year grade.

Papers. — Each teacher should be supplied with at least one package of the colored papers for the fourth year grade.

Other materials are such as have been used already in Geometric Drawing.

METHODS.

Preparation. — All exercises in color should be worked out by the teacher previous to the lesson. It would be well to use large

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tablets, so that the completed exercises may form charts for class use.

Lessons. — A preliminary review may consist of: —

(1) The recognition, matching, and naming of each of the six standard spectrum colors: red, orange, yellow, green, blue, and violet; and the hues: violet-red, orange-red, red-orange, yellow, orange, orange-yellow, green-yellow, yellow-green, blue-green, green-blue, violet-blue, blue-violet, and red-violet.

(2) The arrangement of the standard spectrum colors and their hues, in the order seen in the spectrum.

A good order of steps in a lesson on recognizing, matching, and naming colors is as follows: —

After distributing materials,

(*a*) Study prismatic colors, thrown upon the wall or a screen by means of a glass prism.
(*b*) Select one standard color at a time.
(*c*) Select a tablet to match the chosen color.
(*d*) Give the name of the color.
(*e*) Name objects having a similar color.
(*f*) Quote memory gems referring to the color.

Other lessons are: —

(1) Matching natural colors, — that is, selecting tablets to correspond with the colors of flowers, leaves, shells, etc.

(2) Arranging scales of color from dictation and from memory.

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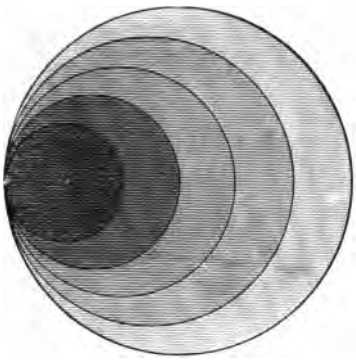
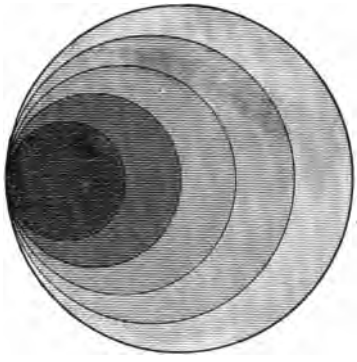
COLOR CHART.

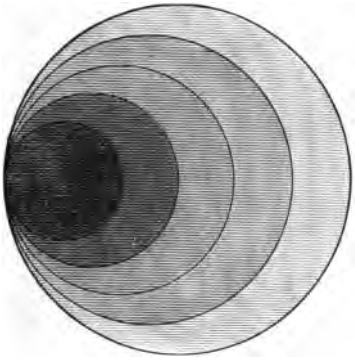
Arrangement of Tints, Standards, and Shades of Spectrum Colors in Scales.



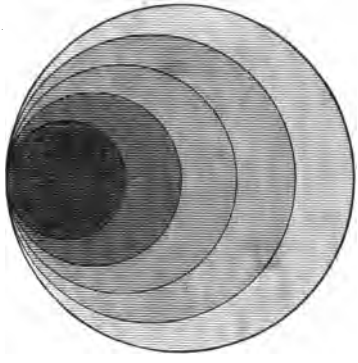
R S 2, R S 1, Red, R T 1, R T 2.



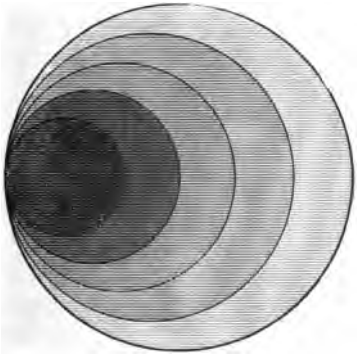
G S 2, G S 1, Green, G T 1, G T 2.



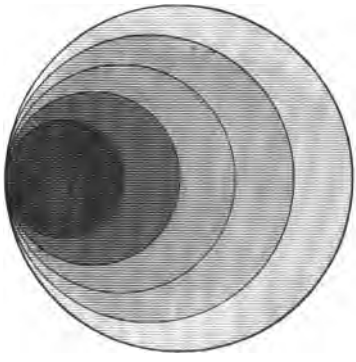
O S 2, O S 1, Orange, O T 1, O T 2.



B S 2, B S 1, Blue, B T 1, B T 2.



Y S 2, Y S 1, Yellow, Y T 1, Y T 2.



V S 2, V S 1, Violet, V T 1, V T 2.

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BOTANICAL DRAWING.

Botanical Drawing includes the study and representation of plant form, as related to ornament and design.

MATERIALS.

Objects. — Seeds and fruits, including pods, collected by the pupils under the supervision of the teacher.

Pencils for botanical drawing should be of medium softness, — a No. 2, or F, — and sharpened to a rather blunt conical point, that the soft outlines of the selected forms may be appropriately represented.

Other materials required are like those already mentioned in other divisions.

METHODS.

Preparation. — The teacher should direct the pupils in the collection of the appropriate seeds and fruits; or, if processes of germination and growth are to be studied, in planting at the proper intervals and caring for the peas, corn, or beans.

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Lessons. — The materials may be used for language lessons before they are drawn, to insure close observation. The following are the steps to be taken by the pupil when drawing: —

(*a*) Select the view to be drawn, and determine its position in the allotted space. (See page 19.)
(*b*) Determine width and height and indicate them.
(*c*) Sketch the general shape of the object.
(*d*) Sketch important and characteristic details.
(*e*) Finish with a line indicative of the character of the object.

Results. — The results should be truthful. Each line should mean something. The drawing should represent the object as it appears — not conventionally.

ILLUSTRATIONS.

Seeds and Pods (Drawing Book IV., page 13).

1

1 and 19. Kernels of Indian corn.
20 and 21. Sprouting Indian corn in different stages.

19

20

21

11 12 13 14 15

2, 3, 11, 12, 14, 15 and 22. Different kinds of beans.
13. Split bean, showing the two cotyledons and leafy embryo.

23. Sprouting bean.

2

3

22

23

24

24. Young bean plant, showing rudiments of first pair of leaves.

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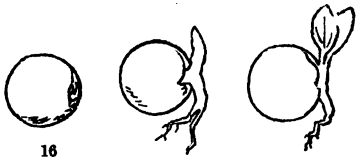
16, 17, and 18. Stages in the growth of peas.



16 17 18

4. Castanea nut.

5. Brazil nut.

5

6. Pecan nut.

6

7. Peanut.

7

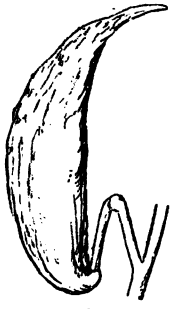
8

8. Bean pod.

9. Milkweed pod (*Asclepias Cornuti*).

10. Pea pod.

10



9

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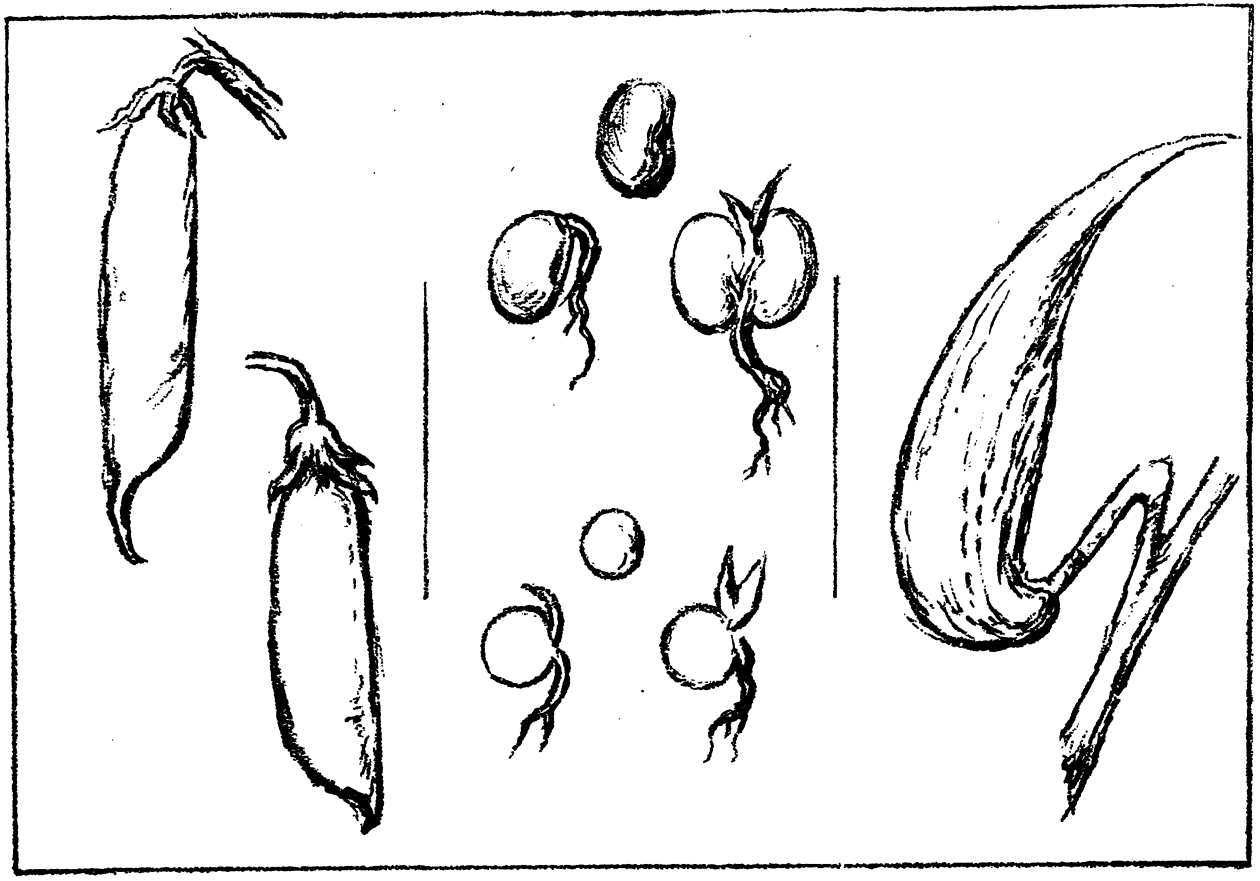

Suggestions for a Page of Botanical Drawing.

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HISTORIC ORNAMENT.

Historic Ornament includes the study and representation of those examples of decorative design which have been preserved from the works of ancient and mediæval artists. A group of artists whose work is similar in its inception or expression forms a *school*. The different schools may be distinguished by certain characteristics; and all Ornament usually studied by modern designers is divided, according to these distinguishing marks, into six groups, schools, or styles, namely: —

Three Ancient Schools, — Egyptian, Greek, Roman.

Three Mediæval Schools, — Byzantine, Saracenic, Gothic.

The subject begins in this grade with simple units, chosen from different schools to illustrate modifications of the square.

MATERIALS.

The materials for study are those to be found in Drawing Book IV., page 14, and such others as the teacher and pupils can gather from books on ornament and photographs of historic

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architecture. In the public library such works may be found and consulted.

Pencil, paper, scissors, etc., as previously described.

METHODS.

Preparation. — The teacher, to do the best work, should be familiar with the outline of the history of ornament (Wornum's "Analysis of Ornament" is a standard work), and with the interesting details of the history of common units like the lotus, the wave scroll, the fret, the lily, the acanthus, the various crosses and symbols used in the different schools. Such information cannot be gathered from any one book, but from general reading on historical subjects connected with art. But for giving the lessons here outlined, a careful study of the notes on the illustrations will enable the teacher to obtain good results.

Lessons. — Steps to be taken by the pupil: —

(*a*) Study the illustrations in Drawing Book IV., page 14. Answer such questions as the following: —

What is common to all?
How many have modified sides?
How many have modified corners?
How many are modified both at sides and corners?
What natural forms do some suggest?
Which present great contrasts of form?
Which are similar?
Which are most beautiful? Why?

(*b*) Sketch one or more examples upon the blackboard or on practice paper in the following order: (1) geometric basal form; (2) principal subdivisions; (3) other lines which determine prominent parts of the figure; (4) sketch of general outline; (5) sketch of details; (6) correction; (7) lining-in.

(*c*) Select one or more, and draw in the book as required. (See page 19.)

(*d*) Practice cutting the units from paper, by folding and cutting as much as possible at once. (See notes on Paper Cutting, page 61.)

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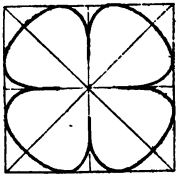
Results. — The pupil should soon acquire an appreciation for simple, well-constructed forms of chaste outline.

The drawings should be as large as the allotted space will allow, accurately proportioned, with good curves, and soft, gray lines, — ideals of decorative form.

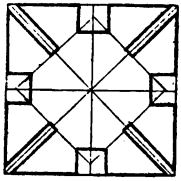
ILLUSTRATIONS.

Historic Modified Squares (Drawing Book IV., page 14).

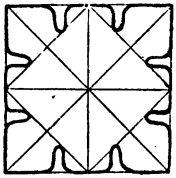
1. An Egyptian unit from an all-over design formed by the equal division of a surface, and exemplifying the first notions of symmetry in the arrangement and distribution of masses.



1

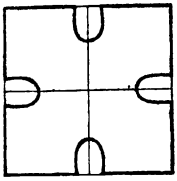


2



3

2, 3, 4. Modified squares, each being a part of Greek borders or frets (interrupted frets). Frets or meanders are interlacings of straight lines, broken and cut, generally at right angles.



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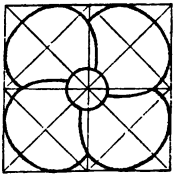

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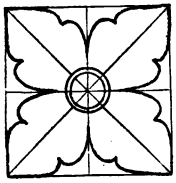

6

5. Roman. Conventionalized flower. Roman ornament employed a scroll growing out of another scroll, encircling a flower or group of leaves. The Romans employed circular curves. The example is from a frieze in mural painting.

6. Japanese. The illustration, a well-rounded leaf form, is taken from an example of cloisonné, or partitioned enamel.

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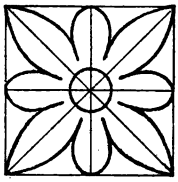
7. Gothic. One of the units of a design in stained glass, from the Cathedral of Chartres (XIIth, XIIIth, and XIVth centuries).

8. Gothic. Square glazed tiles were first used for mural facings in the XIIIth century. The illustration is a design from one of these in the Cathedral of Laon.



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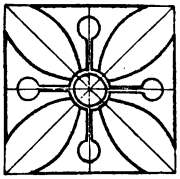
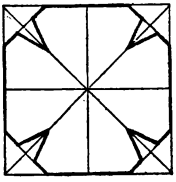


8

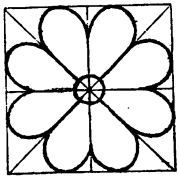


9

9. Saracenic. Mosaic design from the Alhambra, taken from dado in the Baths.

10. Saracenic. One of the panelings of the center recess of the Hall of the Ambassadors in the Alhambra.

11. Gothic. An elaborated form of the Early English "dog-tooth."



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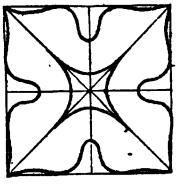
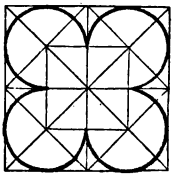


11



12

12. Gothic. Curvilinear form arranged on the inflexible square. This unit forms the basis of much of the design of the XIVth century. It is found in details of the Cologne Cathedral, and also occurs in a design representing painting from a manuscript, executed for Henry II. The paintings are attributed to Jean Cousan.

NOTE. — Some of these are given merely as suggestions for the modification of squares. Such, for example, are Figures 5, 6, and 8. Each of the others may be cut by folding a piece of paper and making one or two cuts.

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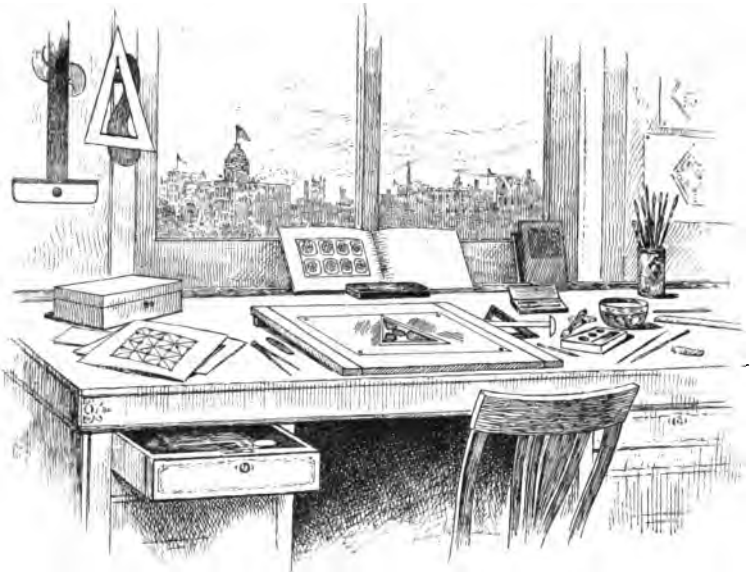

DESIGN.

Design, as a subject, includes the study of designs (whether historic or modern) to determine their structure, their laws and principles, and their form; the modification of geometric figures and the conventionalization of plant forms for units of design; and the creation and expression of arrangements of ornamental forms according to recognized rules.

Laws. — There are three great laws of arrangement; namely, *repetition*, *alternation*, and *symmetry*. These are already familiar to pupils who have taken the primary course in drawing. In addition, there is one great law governing all arrangements making use of plant forms; namely, *growth* — the natural dependence of parts. These laws are fundamental and unchangeable.

Principles. — There are also certain other rules to be observed, called *principles of design*. These have been evolved through comparison of ornamental designs of different schools and times, and serve to guide the designer in his work. Three of

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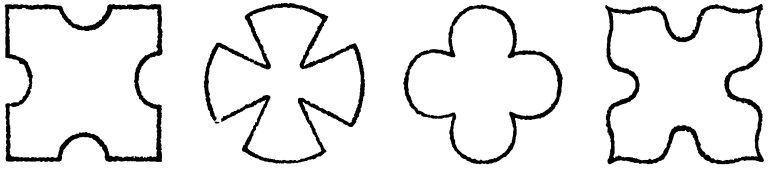
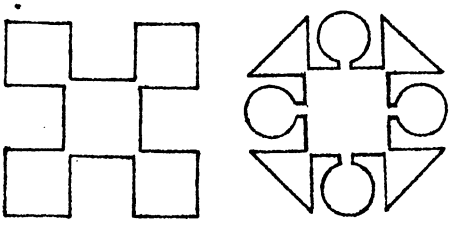
these principles of design should be observed by pupils in this grade: —

1. CONTRAST, — the proper opposition of parts. *Contrast of line* is produced when curved and straight lines are opposed to one another or succeed each other agreeably, as in Figures 1 and 2.



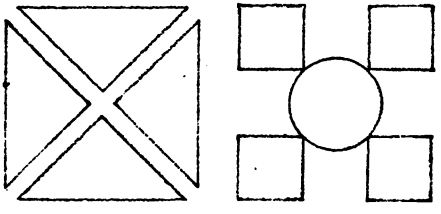
1 2 3 4

Contrast of form is produced when masses of one kind are opposed to or succeed those of another, as in Figures 3 and 4. In Figure 3, the rounded lobe contrasts with the acute sinus; in Figure 4, the pointed lobe with the rounded sinus.



5 6

2. UNITY, — the proper subordination of parts. Figures 1, 2, 3, and 4 illustrate this principle: the lobes are subordinated to the mass; that is, each figure appears to be a *unit*. But Figures 5 and 6 appear to be aggregations of units instead of single units modified.



7 8

3. STRENGTH, — the proper union of parts. Figures 1, 2, 3, and 4 illustrate strength, the lobes being well held together; Figures 5 and 6 show weakness, for the parts seem to have very inadequate support. Perhaps the most flagrant violations of this principle are to be found in such designs as Figures 7 and 8, where the parts are not united at all, or merely by points.

NOTE. — These principles may be forcibly illustrated by folding and cutting paper units similar to those illustrated in Figures 1 to 8.

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MATERIALS.

The materials are such as have already been described under Historic Ornament, and in addition the illustrations in Book IV., pages 19 and 20. A few designs constructed from colored paper will be found helpful in stimulating interest.

METHODS.

Preparation. — The teacher should either enlarge a historic unit or make an original one, and using it as a pattern cut out colored paper units and construct a border (see Drawing Book IV., page 20, Figures 28, 29, 30, and 31) and a surface (Figures 32 and 33). These will serve as charts to illustrate what is required of the pupil.

Lessons. — When reviewing the modification of geometric figures, each pupil should, if possible, have a pair of scissors and a sheet of thin paper, so that each may discover for himself the effects of modifying corners and sides. The principles of contrast, unity, and strength may be taught in connection with this review.

In producing original designs the following exercises are to be performed by the pupil: —

1. *Comparative Study.* — (*a*) Modified triangles, (*b*) modified squares, (*c*) modified oblongs, (*d*) modified circles. The pupil should be able to give intelligent answers to such questions as these: —

   What principle of design is illustrated in Figure 4? In Figure 6? In Figure 22? etc.

   Do any of the illustrations violate a principle?

   Which is more beautiful, Figure 9 or Figure 11? Figure 12 or Figure 15? etc.

   Can you give a general rule for modifying triangles? squares? oblongs? circles?

2. *Cutting Selected Units.*

   (*a*) Have a 4″ square of thin paper.

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(*b*) Fold it (see notes on Paper Cutting, page 61), and draw one eighth of the selected unit, properly enlarged.[1]

(*c*) Cut the unit.

3. *Cutting Original Units.*

The steps are similar to those just given. After the paper square has been folded, remember that modifications may be produced by straight cuts or curved cuts at corners or on sides; that a very little modification is often better than more; and that it is almost impossible to make a modification that is not original. The first results may be crude, but if they are produced by the pupil's own thinking — not copied — they may be commended.

4. *Drawing Original Units.*

Prepare the page in the drawing book as directed, and draw the unit the proper size. (See page 20.)

5. *Copying a Design.*

(*a*) Determine how many times the figure is to be enlarged to properly fill the allotted space.

(*b*) Draw accurately the oblong containing the design, the proper size for the space.

(*c*) Subdivide it, by lines which help in drawing the units, into as many parts as there are units in the figure. (For example, in Book IV., page 20, Figure 32, the lines would be vertical and horizontal, dividing the space into squares. In Figure 33 the lines would be oblique, dividing the figure into squares *on their diagonals* and half squares.)

---

[1] *Note on Enlargement.* The unit to be enlarged is, in each case, based on a geometric figure. (*a*) Draw the geometric figure upon which the unit is based of such a size as to look well in the space: (*b*) draw the diameters or diagonals, or other lines which aid in establishing definite points in the figure: (*c*) enlarge each part proportionally — that is, if a curve in the figure extends to the middle of a semi-diameter, it should extend to the middle of a semi-diameter in the drawing; if a cut occupies one third of a side in the figure, it should occupy one third of a side in the drawing. ☞ The pupil should be trained to enlarge by the eye, without measuring proportions; therefore, measurement of proportions should *always follow* the freehand sketching of the parts, never precede it.

The drawing of decorative units at this early stage may be freehand, if the pupil needs special training in freehand drawing; when, however, the units are to be used in designs, — repeated many times perhaps. — mechanical aids should be employed to insure accuracy.

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(*d*) Draw one unit with the utmost precision; transfer it, that is, reproduce it in the other squares either by measurement, by tracing around a paper unit, or by the use of tracing paper.[1]

(*e*) Erase all construction lines, and make necessary corrections.

(*f*) Line-in the design and add half-tinting if required. (See Note, page 60.)

6. *Drawing the Original Design.*

Steps are similar to those just outlined. The original unit may, perhaps, now be modified slightly, to advantage, for the *spaces* between the units may be made as important a decorative feature as the unit itself. (Notice the new forms suggestive of units, made evident by the half tinting in Figure 33, on page 20 of Drawing Book IV.)

7. *Constructing from Colored Paper.*

(*a*) Select two or three tones from one scale. (See notes on Harmonies of Color, page 41.) If the design is for a surface, two tones will be enough, — one for the ground and one for the unit. If for a border, three may be used, — one for ground, one for units and margin, one to outline or separate the margin from the ground.

(*b*) Make the ground for the design of the proper size, and on its white side draw lightly the construction lines for the design (these will aid in determining the size of the units); then number and space over the ground.

(*c*) Cut one unit from "oak tag" as a pattern, and trace and cut the others from this.

(*d*) Cut the margin lines if any are required.

---

[1] *Note on Tracing.* After a quarter of a unit is drawn, lay a piece of tough tissue paper, or better, genuine tracing paper or tracing cloth, over the unit, and trace the outline with a well-pointed and rather soft pencil. Place dots on the tracing paper indicating the corners of the square and the ends of diameters, to assist in correctly placing the tracing upon other sides of the square. Fit the tracing, *drawn side down*, upon another side, and go over the outline again. Repeat for the other sides, reversing the tracing paper each time. Entire units may be traced and transferred in a similar manner.

When a tracing cannot be reversed, blacken the under side of the tracing paper by going over it with a soft lead pencil, and place it blackened side down in the proper position. Go over the lines of the drawing with a hard pencil. This will leave an impression of the drawing upon the page.

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(*e*) Fasten the units in their proper positions, using little glue. Never cover the entire under-surface of a unit with glue; the design will not dry flat. Add the margins if required. (See notes on Paper Cutting, page 61.)

Results. — The original units may be considered good at this stage, if they do not violate a principle of design and are well drawn and cut.

The drawings should be clean and clear. The soft, broad, gray line is out of place in surface decoration; it is too indefinite, and occupies too much space. A delicate, gray line is preferable.

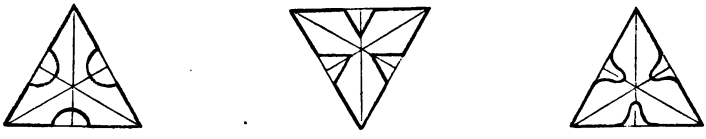
The constructed designs should be correct in spacing, accurate in cutting, and neatly glued.

The *end* to be secured is *beauty*. Every means should be used to obtain an ideal result.

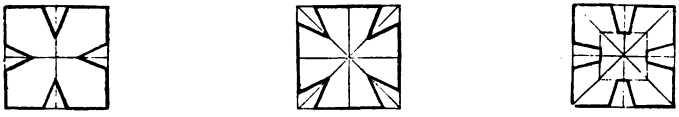
ILLUSTRATIONS.

Modified Geometric Units (Drawing Book IV., page 19).

1, 2, 3. Modified obtuse-angled triangles.



4, 5, 6. Modified equilateral triangles.



7 8 9

7, 8, 9. Square units, produced by modifying with straight cuts.

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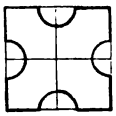

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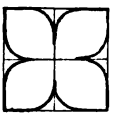

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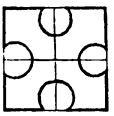

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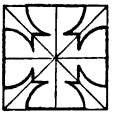

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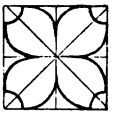
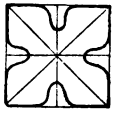


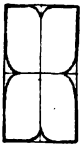
15

10, 11, 13, 14, 15. Square units, produced by modifying with simple curves.



12

12. Square unit, having reversed curves.



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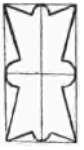

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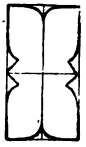

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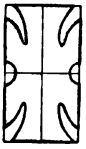

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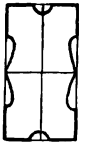

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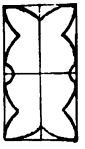
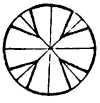


21

16, 17, 18, 19, 20, 21. Oblong units.



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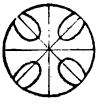

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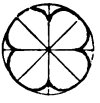

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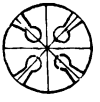

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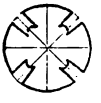

27

22, 23, 24, 25, 26, 27. Circular units.

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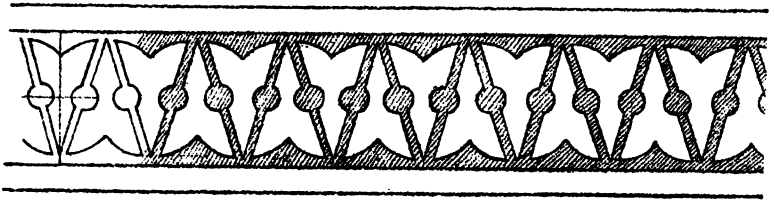
Borders, with Modified Units.

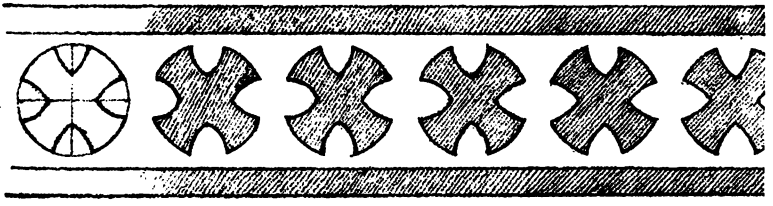
28

28. With square units.



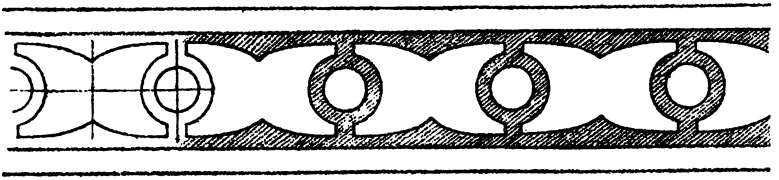
29

29. With triangular units.



30

30. With circular units.



31

31. With oblong units, alternated with small circles.

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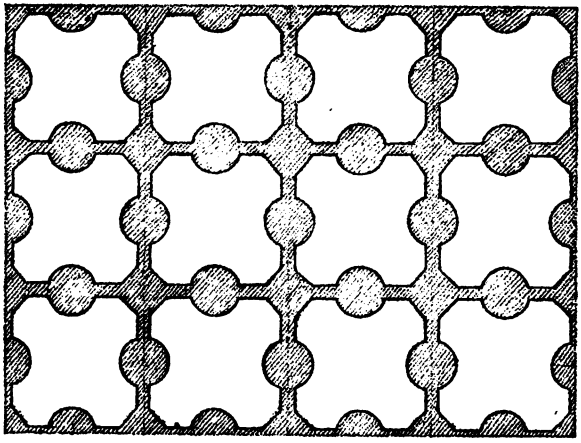
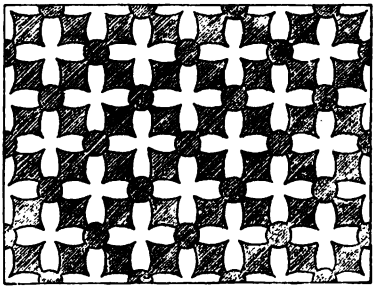
Surfaces, with Modified Units.



32 *b*.

32. (In Drawing Book only.) Square units without half-tinting.
32 *b*. (Not in Drawing Book.) The same as Figure 32, with half-tinting.
33. Square units with half-tinting.

NOTE. — Half-tinting is a uniform tone produced by soft, fine, parallel lines added to a design to make its parts clearer by contrast. A design drawn in outline only does not always pronounce itself sufficiently; for example, in Figure 32 it is difficult to decide at first glance whether the units are crosses and circles or modified squares — the spaces rival the units. In such cases, half-tinting will reveal the true units, and give repose to the design. Compare Figure 32 in the Drawing Book with Figure 32 *b* above.



33

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PAPER CUTTING.

Paper Cutting includes the making of units of design or other ornamental details for use in constructing designs of colored paper. It is an elementary form of Applied Design, and may illustrate the essential principles of good design for surface decorations, such as ceiling patterns, wall papers, and carpets.

These essential principles are: —

1. *Flatness.* — Surfaces which are to be used as backgrounds for pictures, furniture, etc., should not be so ornamented that their apparent flatness is destroyed. Perspective effect or the appearance of high relief are entirely out of place.
2. *Equable Distribution of Masses.* — Irregular or large uncovered portions of surface should not occur in the same pattern with closely placed units, unless the intention is to produce a stripe. But pronounced stripes are out of place in floor coverings, and, as a rule, in wall or ceiling papers. Stripes tend to lead the eye rapidly over the surface, and off it; the pattern should simply enrich the background without giving it prominence or making it obtrusive.

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3. *Harmonious Coloring.* — The specially prepared colored papers furnish the very best means for the employment of harmonious coloring in elementary designs.

MATERIALS.

Paper. — For cutting patterns to be used in tracing other units "oak tag" (used in Development) is best. For folding and cutting a number of thicknesses at once, the thin, soft, colored papers are best. Thick or stiff papers do not fold closely.

For constructing designs the Bradley colored papers (selected by the authors, and known as WHITE'S) are best.

Scissors. — Sharp, steel scissors are best for this work. Cheap iron scissors tear the paper instead of cutting it, and soon get out of order.

Other materials are like those already used.

METHODS.

NOTE. — Nearly all paper cutting should be taken in connection with other work, — Historic Ornament and Design. (See notes on these subjects.)

Preparation. — The teacher should work out the exercise previous to the class lesson, to discover any points of difficulty.

Lessons. — Steps to be taken by the pupil: —

1. *Making a Pattern.*
   (*a*) Draw the geometric figure upon which the unit is based with the utmost accuracy, using fine sharp lines.
   (*b*) Sketch very lightly the mass of the *whole* unit, to insure correct general proportions.
   (*c*) Draw one quarter as perfectly as possible.
   (*d*) Draw the other quarters by transferring from the first, either by measurement or by tracing. (In simple units the first quarter may be cut, and the *piece* used in tracing the shape of the other quarters.)
   (*e*) Cut out the unit, following the drawn lines. Make smooth regular cuts, that the pencil-point may pass smoothly around them when tracing.

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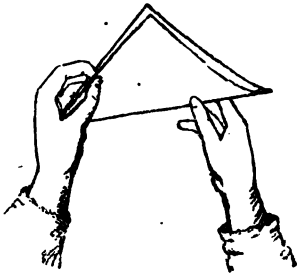
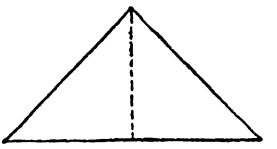
2. *Cutting a Unit, folded.*

(*a*) Select a square of the right size and color.

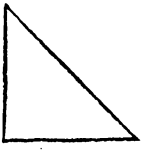


(*b*) Fold it upon a diagonal.

(*c*) Fold it upon the other diagonal, indicated by the dotted line in *c*; the paper will then have the shape c^2.

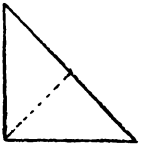


c

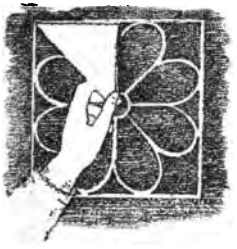


c^2

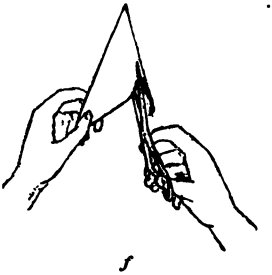
(*d*) Fold it to make the diameters of the square, indicated by the dotted line in *d*. The small folded triangle will now be equal in area to just one eighth of the original square.



d



e



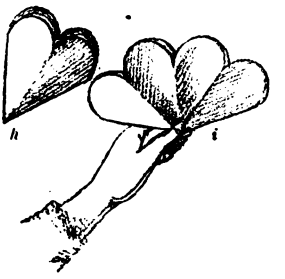
f

k

(*e*) Hold the paper triangle by the point which corresponds with the center of the square (see *e*), and draw upon the triangle *that portion of the outline of the unit which is covered by the paper.*

(*f*) Hold the paper firmly to prevent slipping, and cut on the drawn line (see *f*). The paper will then have the shape *g*. Unfolding, the shapes *h*, *i*, and *k* will be revealed. (Figure 10, in Historic Units.)

g



h *i*

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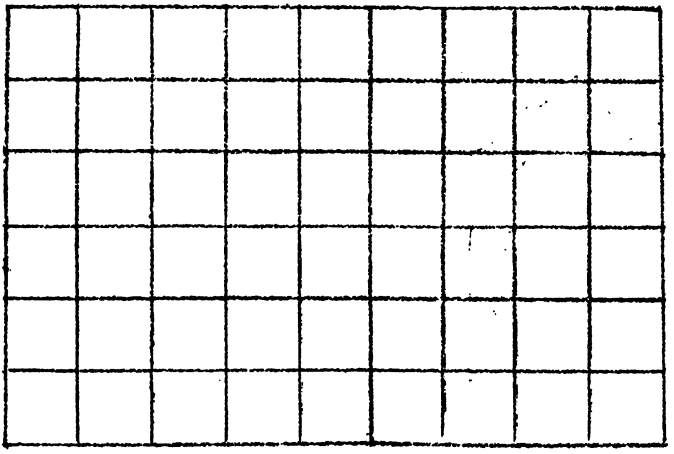


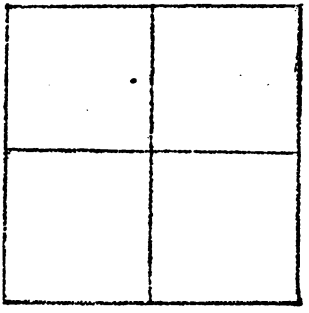
a

3. *Constructing a Surface Design.*

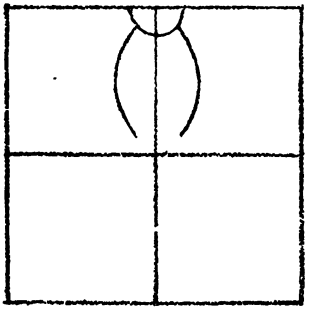
The selected example is Figure 33, on page 20 of Book IV.

This design may be constructed in two ways; 1st and simplest, — by dividing the surface into squares by means of oblique lines, and cutting units to fit into these squares; and 2d, as follows:

(*a*) Select a sheet of proper color and size for a background. Draw lines accurately upon the back or white side, which shall by their intersections locate the *centers of units*, and the centers of the circular spaces between units.



b



c

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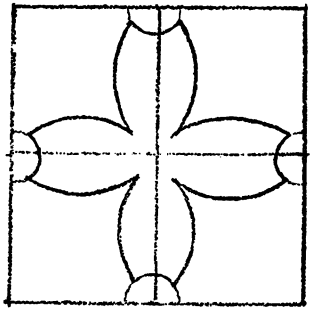
(*b*) On a sheet of "oak tag" draw accurately, and of exact size, *four* of these small squares, grouped to form one large square. (They are shown enlarged, for convenience, in *b*.)

(*c*) This large square now circumscribes one unit, and its diameters form the axes of its arms.

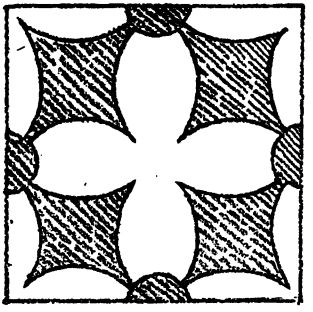
Draw accurately one arm, *c*.

(*d*) Draw the other arms, by transferring the lines of the first.

(*e*) Cut out the pattern, and by it cut a sufficient number of units from paper of the proper color.



d



e

(*f*) Apply these units to the ground as indicated at *e*. The square corresponds to the large square formed of four small ones at *b*. One unit is shown, whose center coincides with the center of the large square. One quarter of each of four other units shows at each corner of the large square. The half-tinting indicates ground. The completed design is shown in Figure 33, page 60.

Page 66 shows a design constructed from three colors of paper. The dark squares are added to the units after the units have been glued to the background.

Results. — The pupils should be taught to lay out their designs so that they will *repeat*. That is, opposite sides or opposite ends should correspond; if units are divided in the middle at one side, they should be so divided at the opposite side of the design.

The constructed design should be harmonious in color, accurately cut and spaced, and neatly constructed.

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A Design constructed with Colored Papers.

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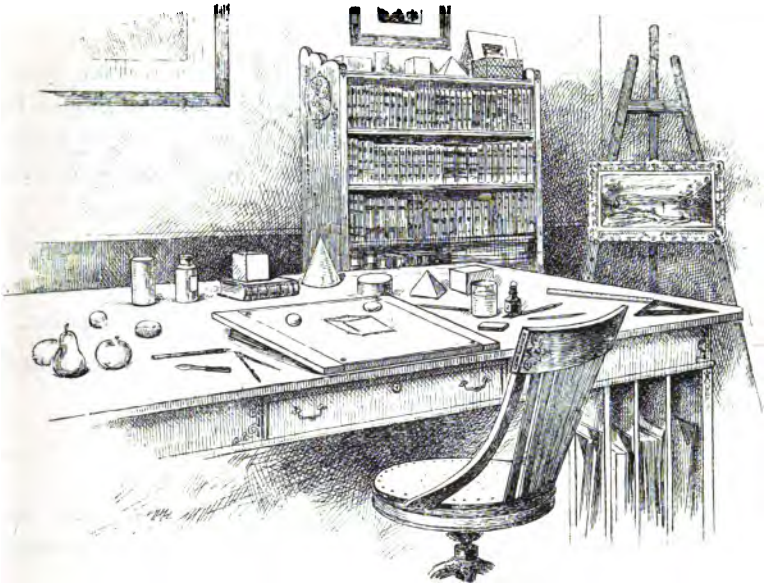

3. PICTORIAL DRAWING.

MODEL AND OBJECT DRAWING.

Pictorial Drawing includes the study and representation of objects as they appear to the eye from one point of view.

Type Solids. — The principles which govern the correct pictorial representations of objects may best be learned through the study of type solids, which lack perplexing details.

Applications. — When the principles are learned, they should be applied in the pictorial representations of

(*a*) Objects similar to the type in form.
(*b*) Groups of objects based on types.
(*c*) Sketches from nature, — landscape, etc.

MATERIALS.

Models. — Each pupil should be supplied with White's Drawing Models for advanced classes. During this year he will need the sphere and spheroids only.

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Objects. — Each pupil should be supplied with objects based on the type forms. For the first lessons, the objects should be alike if possible, — that is, each pupil should have an apple. But later, each pupil may select his own application, — one an orange, one an apple, one a pear, etc.

Paper. — Manilla practice paper, 9″ x 12″, is best for first work.

Pencil. — The pencil should be of medium softness, — an F, or M, or No. 2, and sharpened to a rather blunt, conical point.

Wire. — A piece of wire or a knitting-needle will be found very helpful in determining levels.

METHODS.

Preparation. — The teacher should work out each exercise before giving it as a class lesson, to insure easy and logical steps for the pupils.

Lessons: I. *Type Solids.*

NOTE. — Model drawing, or drawing from type solids as they appear from one point of view, is the basis of all pictorial representation. Continued practice, intelligently guided by principles, will insure correct, accurate drawing.

A certain amount of preparatory drill may be required before drawing directly from models.

1. *Preparatory Drill: Effects of Distance.* — Lead the pupil to see that objects seen at a great distance appear smaller than similar objects when near, — houses, trees, etc., for example. What is true for great distances must be true proportionally for short distances. One effect of distance, then, is to *decrease* the apparent size of an object. Hold the pencil — or, better, a wire — horizontally in front, and at arm's length. Closing one eye, move the wire until it appears to coincide with the back edge of the desk. Hold it to appear to coincide with the back edge of the next desk in front. Must the wire be raised or lowered? The two desk-edges are practically at the same level, but one is farther away. Another effect of distance, then, is *to change the apparent level* of objects. Give many illustrations of this.

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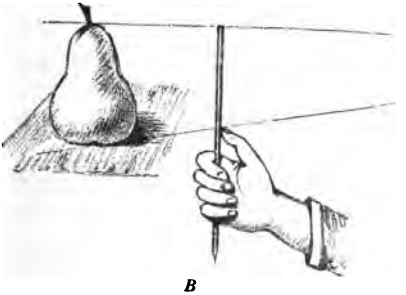
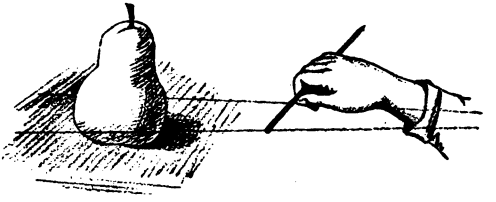
2. *Preparatory Drill: Proportional Measurement.* — Sit erect; hold the pencil vertically at arm's length in the position indicated in *A*. Close one eye; with the other, sight over the top of the pencil to what appears to be the highest point on the object; and over the thumb-nail, held against the pencil (see *B*) sight the lowest point visible on the object. A certain distance on the pencil will now appear to cover the entire apparent height of the object. Now turning the pencil horizontally, the entire width may be measured in a similar way (see *C*). By comparing the two measurements on the pencil, their relative lengths may be determined.

A



B

☞ Such measurements should always be taken at arm's length in this grade. *They do not give size:* they give *proportion only.* They should be used principally *to test* sketches. As a rule, the first lines of the sketch should be drawn as they appear to the unaided eye, that the judgment of proportion may be trained. Later, proportional measurement will be rarely used.



C

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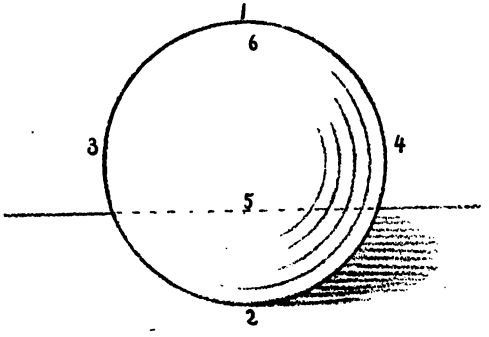
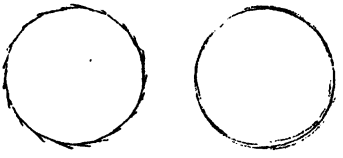
3. *The Sphere.* — Steps to be taken by the pupil.

(*a*) Place a 2″ sphere in the groove at the back of the desk, and in the center from side to side, — directly in front of the observer.



(*b*) Hold the wire horizontally, so that it appears to touch the highest point visible (1); the lowest point visible (2). Hold the wire vertically so that it appears to touch the point farthest to the left (3); farthest to the right (4).

(*c*) Decide upon the size of the drawing and indicate these four points on the paper.



(*d*) Sketch the general outline of the sphere by either method preferred (*a*, *b*).

(*e*) Hold the wire so that it appears to cover the back edge of the desk. How much of the sphere appears above the wire? How much below? (5–1 above, 5–2 below, in the large figure.)

(*f*) Sketch the shelf line, or ground line, as it is called.

(*g*) Make a spot on the highest point of the surface of the sphere.

(*h*) Represent this in the drawing. (6.)

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(*i*) Erase mistakes.

(*k*) Line-in, with an even gray line, making the outline of the sphere a little darker than the ground line.

4. *The Spheroids.* — The steps are similar to those already given for drawing the sphere.

5. *The Ovoid.* — This will require more care, but the steps are the same.

II. *Single Objects.*

NOTE. — Object drawing shows the application of principles learned in model drawing. Intelligent practice should give facility in drawing, and will lead to a love for natural beauty, to an appreciation of artistic representation, and to some knowledge of pictorial composition and pictorial art.

1. *Applications of the Sphere.* — Steps to be taken by the pupil: —

(*a*) Having selected a suitable object, place it at the back edge of the desk, directly in front of the pupils who are drawing it.

(*b*) Study the object, comparing it with its type solid; determine its proportions, and how it shall be placed upon the paper.

(*c*) Indicate on the paper its width and height.

(*d*) Sketch the outline.

(*e*) Sketch the ground line.

(*f*) Sketch important, characteristic details.

(*g*) Correct if necessary.

(*h*) Line-in with lines expressive of the character of the object.

2. *Applications of the Spheroids.*

3. *Applications of the Ovoid.*

In all these the steps are precisely similar to those already given for spherical objects.

NOTE. — *On Character of Line.* While it may not be possible in this grade to get much "feeling" into the drawings, the pupils should at least know something of the "handling" required to produce the effect of difference in texture. These different handlings can hardly be described, but they may be illustrated.

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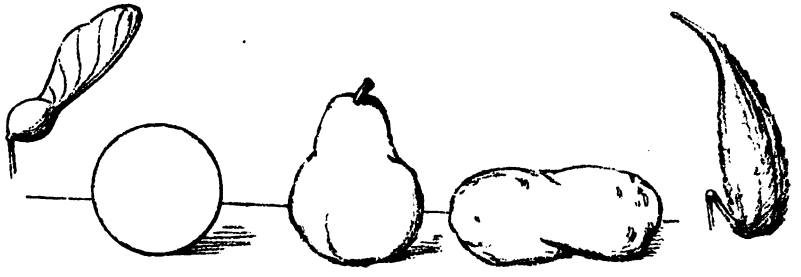
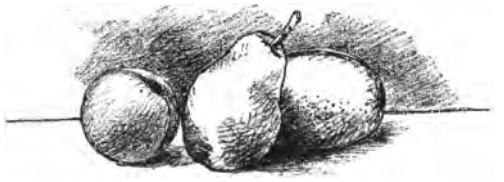
Generally speaking, a delicate line (1) indicates thinness and delicacy of structure; an even, rather narrow, gray line (2) indicates contours of objects having smooth even surfaces; broken gray lines of different strengths (3, 4) indicate irregular and rough surfaces; broad gray lines (5) almost invariably give the effect of very rough or wooly or fuzzy surfaces. But after all no fixed rules can



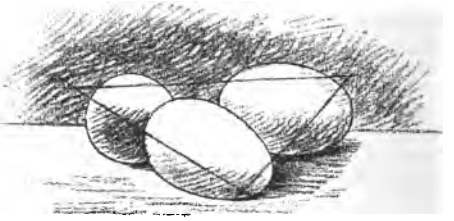
be established for the use of lines to give texture. If the artist *thinks* texture while drawing, his lines will show it. If he admires a peculiar kind of line and always uses that, his drawings will be prudish and conventional.

III. *Groups.*

Note. — Pictorial composition, or grouping, is the art of arranging objects in a picture to suggest a story pleasantly. A mere collection of objects is not necessarily a group; they must be arranged with reference to some one principal object, occupying the most prominent position, to which all the others are accessory, simply leading up to the principal. For example, in the group of fruit at the left the pear is the *principal* object, the others are *accessory*.



The objects should be placed so that the eye may comprehend the whole group at once, without being attracted successively by different accessories. As a rule, avoid parallel lines in grouping; that is, do not place all objects at the same apparent level, nor allow long lines in two adjacent ob-



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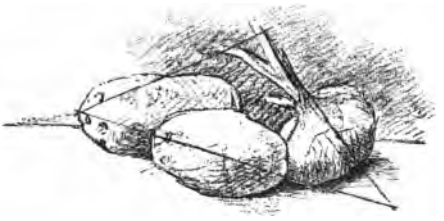
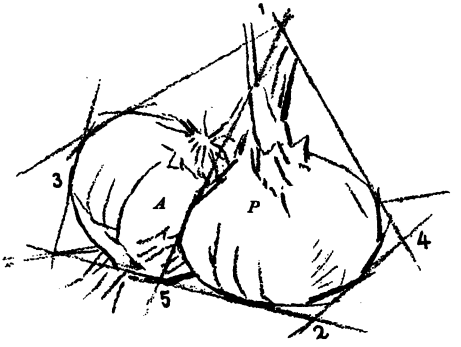
jects to have the same direction. Generally, the most satisfactory groups are triangular in mass, as shown in the accompanying illustrations.



1. *Groups of Models.* — Steps to be taken by the pupil: —
   (*a*) Arrange a group, observing the simple rules of composition. (See foregoing note.)
   (*b*) Indicate on the paper the extreme width and height of the group.
   (*c*) Sketch the entire mass of the group.
   (*d*) Determine and indicate the relative positions and sizes of individual objects.
   (*e*) Sketch each object in mass.
   (*f*) Correct, if necessary.
   (*g*) Draw carefully the principal object.
   (*h*) Draw the accessories.

2. *Groups of Objects.* — The steps are the same as in sketching a group of models: Whole height, 1–2; whole width, 3–4; entire mass, 1–3–2–4; relative masses of objects, 1–5–2–4 and 1–3–5; sketching principal object, *P*; and accessory object, *A*. In finishing such groups, give most attention to the principal object, bringing out clearly its important and characteristic marks. Emphasize only essential details in accessories.



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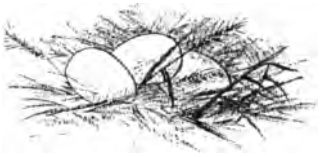
IV. *Sketching from Nature.*

The pupils of the fourth grade in school are not too young to begin outdoor sketching. Each should be supplied with a little sketch-book of manilla paper, and encouraged to use it constantly.



At first the pupil may find it best to sketch such natural forms as may be suggested by his school work, — such, for example, as those here shown; but later, any object or group which attracts attention as pleasing may be attempted. Select simple subjects; do not be too ambitious at first.

The same steps are to be taken in outdoor sketching that were taken in the schoolroom when sketching from objects. Practice will secure good results.

Results. — The pupil should soon form the habit of thinking *solids* when studying the *drawing* of solids; that is, he should think in three dimensions, — height, width, and thickness. In the figure on page 75, for instance, he should think: vertical plane from ground line up, behind the sphere; horizontal plane from ground line forward, under the sphere; sphere, a solid body resting upon one plane and in front of another.

The page in the drawing book may be arranged as on page 75. The outside oblong represents the edges of the page; the inner oblong is the margin line. Two spheres of different

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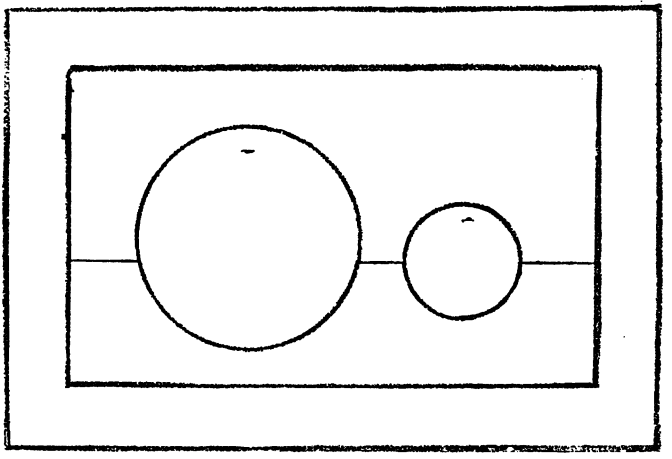
sizes are represented. In every case the margin lines and ground line should be drawn, as well as the object.

In object drawing, the fewest possible number of lines should be used to graphically represent the object. No line should be meaningless; if it is useless it should not appear.

Many simple, thoughtful drawings are better than one or two laboriously finished to the finest detail. A simple drawing roughly executed may show the *character* of the object, and that is of more importance than any particular detail.



In objects and groups a suggestion of light and shade may be added. (See illustrations, Book IV., page 28.)

Encourage sketching in connection with work in Language, History, Geography, and Nature Studies.

Show the pupils examples of good pictorial art, photographs of historic buildings and their ornament, examples of carved and molded enrichment, vases, and other beautiful forms. If a museum of art is in the vicinity, visit it often, and lead the pupils to love and look for the beautiful in all things.

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ILLUSTRATIONS.

(Drawing Book IV., pages 27, 28.)

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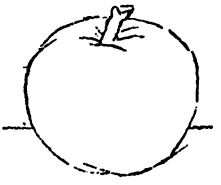

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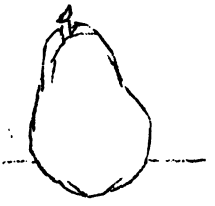

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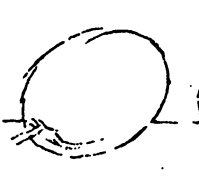

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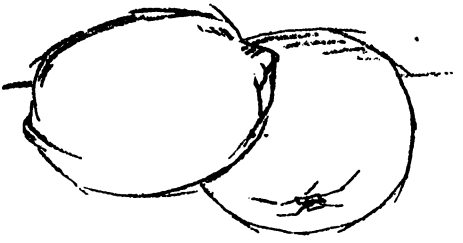

15

Type Solids.

1. Spheres (with outline of page and margin lines).
2. A sphere with spot showing highest point on the surface.
3. An ovoid.
4. A spheroid.
5. An ovoid with axis somewhat at an oblique angle with the line of observation.

Applications.

6. An apple, stem down.
7. A pear, on its side.
8. An apple, stem up.
9. A pear, upright.
10. A plum.
11. A tomato.
12. A potato.
13. A turnip.
14. A lemon.

Groups.

15. An orange and a lemon.
16. Two onions.

NOTE. — The illustrations here given show simply the first sketch. See Drawing Book for finished drawings.

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PRACTICAL APPLICATIONS OF DRAWING IN MAKING USEFUL OBJECTS.

THE plates following page 78 are added to suggest a few of the many applications of drawing in the construction of simple useful objects.

On the plates, a variety of exercises are given for reference, and many patterns specially suitable for wood-work and needle-work. If there is time, these objects may be made in the school-room under the supervision of the teacher. If not, instruction may be given upon the kind of objects which may be made; the kind, size, and thickness of the material to be used; and the method of making the pattern on the material from which the object is to be made. It would be well to have the pupils construct the objects first from paper, then from wood or cloth.

The Geometric Forms, commonly used as a basis for the various objects made, are the Square, the Oblong, and the Triangle.

Objects based upon these three rectilinear figures, which may be cut from wood: table mat, cubical box, twine reel, frame, T-square, key tag, paper-cutter, crewel reel, corner bracket, etc. The modified geometric figures as found in the illustrations for Historic Ornament and Design are excellent patterns for cutting in paper or wood.

The wood of the tulip tree, commercially known as "white-wood" and "basswood," is the best for making these objects. These are soft woods and can easily be cut with a knife. One eighth of an inch is about the right thickness.

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Objects based upon the three type forms which can be made from cloth, leather, or paper: penwiper, handkerchief case, doily, needle-book, picture frame, photograph case, cardcase, bag, brush and comb tray, glove box, catch-all, bracket, and wall-pocket.

Materials to be used in making the various objects:—

Penwiper: felt, cloth, or chamois skin.

Handkerchief Case: "oak tag," silk, plush, or cloth. Colored chamois, covered with muslin, will make a very pleasing and useful article.

Box (for handkerchiefs, jewelry, or gloves): "oak tag" or cardboard, covered with one kind of material and lined with another kind.

Doily: linen or linen lawn. The embroidery should be done with linen floss, embroidery silks, or marking cotton.

Picture Frame: silk, satin, plush, leather, embossed paper, stiff cardboard, or "oak tag."

Cardcase: leather, velvet, or silk. The lining should be of silk or satin of contrasting color.

Brush and Comb Tray: butchers' linen and jean are the most useful materials, as they can be laundered.

Catch-all: "oak tag," cloth, silk, velvet, chintz, or cretonne, and a different material for lining.

Bracket: bristol-board, embroidered cardboard, or wood.

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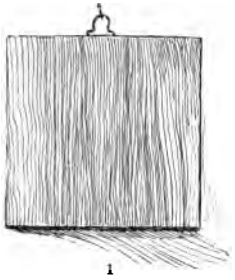

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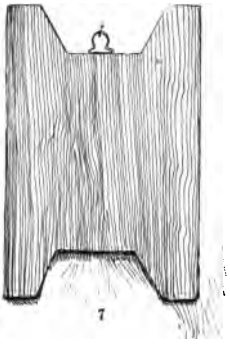

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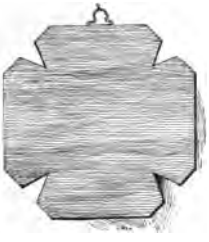

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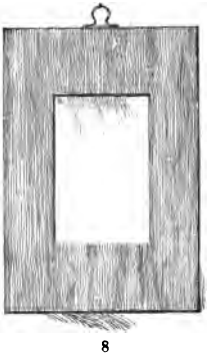

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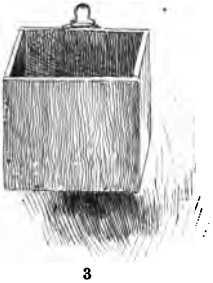

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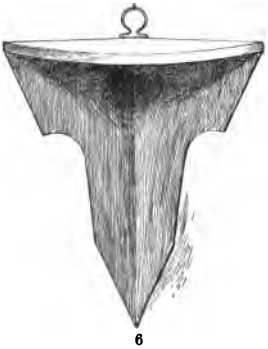

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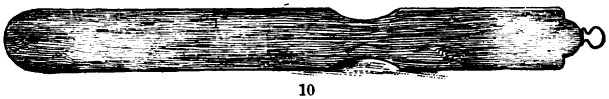

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PLATE I. — 1, Square; 2, Table Mat; 3, Box; 4, Triangle; 5, Crewel Reel; 6, Bracket 7, An Angler's Reel; 8, Picture Frame; 9, Key-tag; 10, Paper-cutter.

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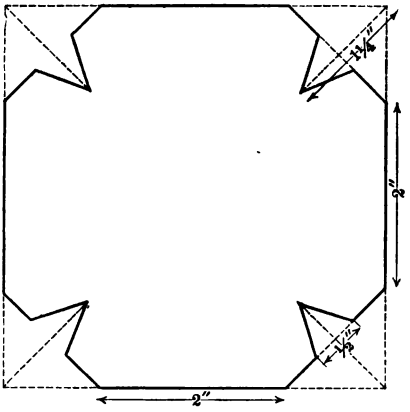

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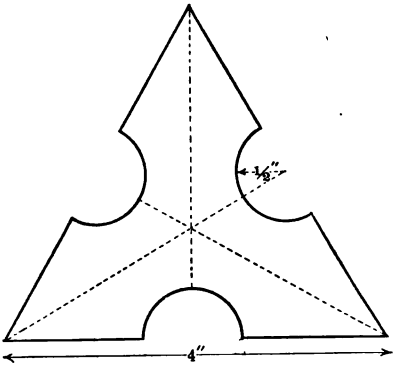

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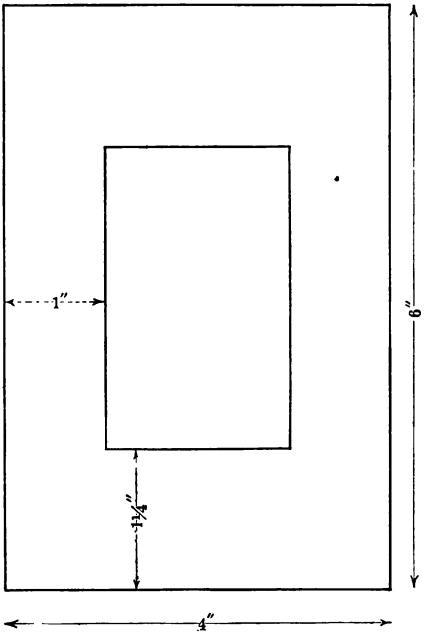

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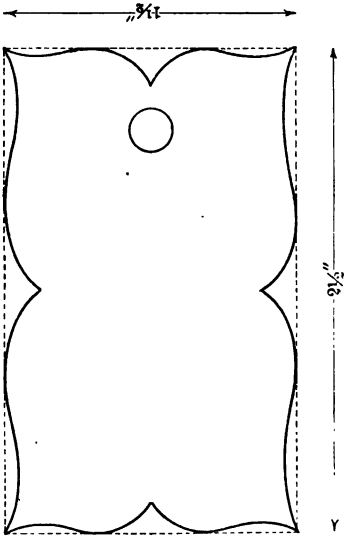

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PLATE II. — 11, Table Mat; 12, Crewel or Silk Reel; 13, Picture Frame; 14, Key-tag.

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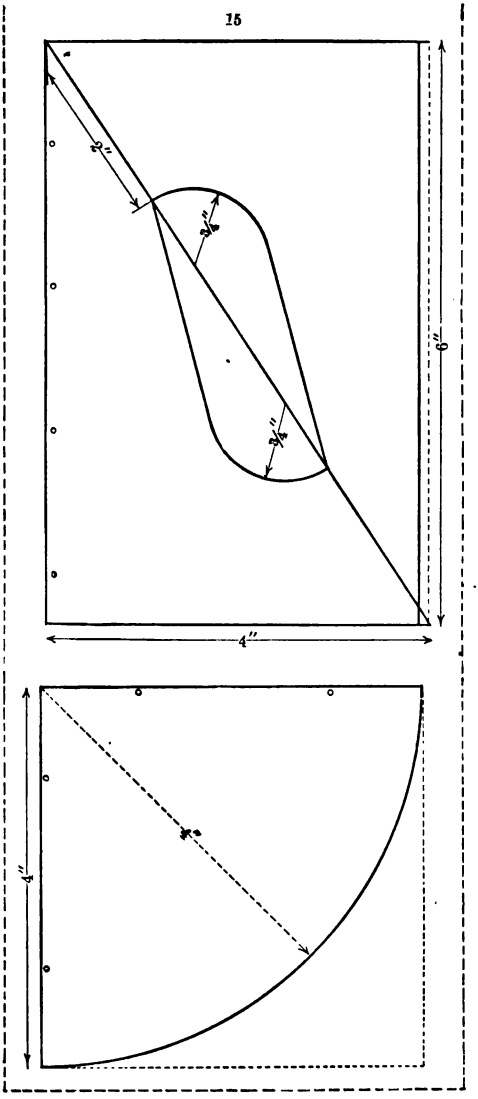

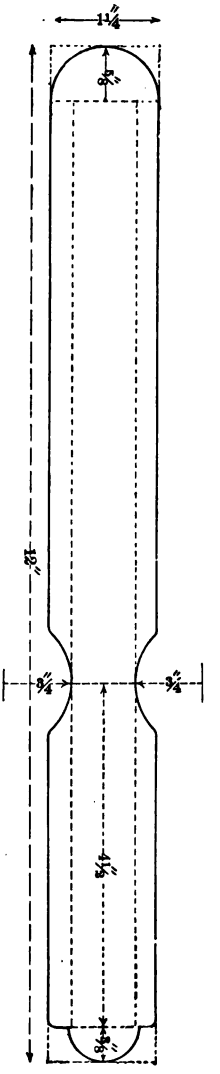

PLATE III. — 15, Two Sides of Corner Bracket; 16, Top of Corner Bracket (see Plate I., No 6); 17, Paper-cutter.

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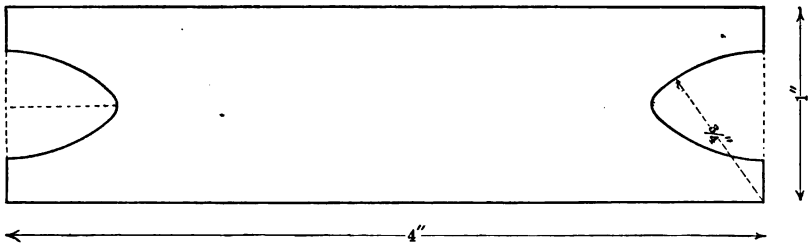

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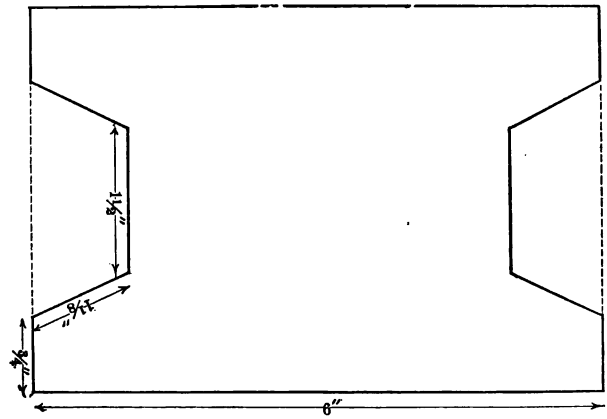

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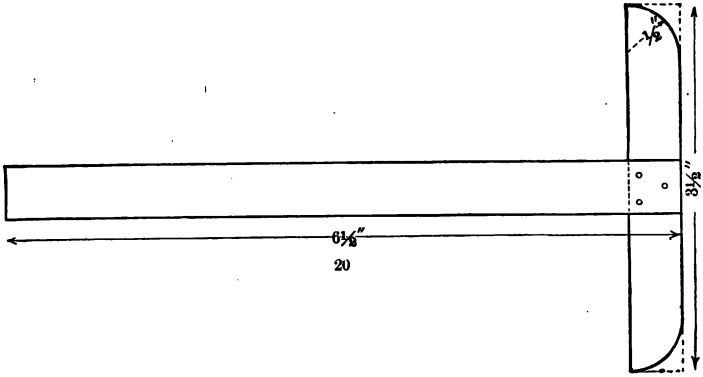

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PLATE IV. — 18, Fishing-line Reel; 19, Twine Reel; 20, T-square.

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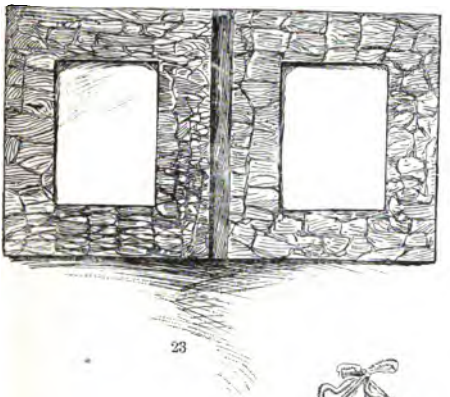

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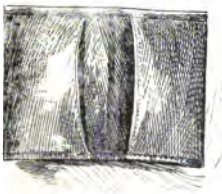

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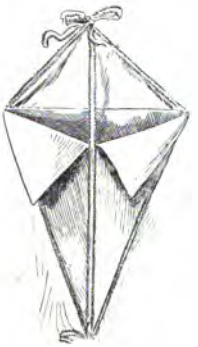

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PLATE V.—21, Dolley; 22, Handkerchief Case; 23, Picture Frame; 24, Penwiper; 25, Cardcase; 26, Catch-all; 27, Table Mat.

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BLACKBOARD ILLUSTRATIVE SKETCHING.

INTRODUCTION.

THE power to illustrate lessons by sketches upon the blackboard is now not only recognized as important to the teacher, but even essential. Number, reading, language, plant, and animal lessons in primary grades, and geography, history, zoölogy, and botany lessons in grammar grades, may be properly accompanied by blackboard sketches.

Illustrations help the word descriptions by addressing the mind through one more avenue — that of sight. They add interest to a lesson, and gain involuntary attention from the pupils; and that which is listened to with interest makes a deeper impression upon the mind.

Blackboard sketching in light and shade is a very simple thing when considered intelligently; and an enthusiastic teacher, who is willing to try, will find that she can accomplish much with but little effort.

The sketches on the plates following page 90 are mainly limited to such illustrations as will be found useful in the lessons on Pictorial Drawing; but there are also sketches which will indicate how fully plant, animal, and geography lessons may be illustrated.

Teachers and pupils should make collections of pictures, illustrating lessons in the year's course, and mount them on cards, or in scrapbooks, for future use or reference. They should make original illustrations of a simple character for lessons that are given in their classes. By drawing these on blackboard paper, they can be preserved for future use.

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EXERCISES ON STRAIGHT LINES.

(See Illustrations, Plate I.)

In rapid and effective sketching, the side of the crayon should be used, as this produces broad marks of various widths, (according to the angle at which it is placed with the direction of the marks,) to which the texture of the blackboard gives the desired transparency.

Vertical Strokes. — Use common crayon of medium softness. Allow the body to be poised naturally, keep erect and at arm's length from the board. Each stroke should be produced by a free movement from the shoulder, without bending the arm at the elbow. Bearing firmly upon the board with the side of the chalk, and beginning at a convenient height above the level of the shoulder, draw, with an even pressure, vertical strokes of a foot or more in length. Repeat the exercise until vertical strokes can be executed easily and rapidly.

Horizontal Strokes. — Hold the crayon in a vertical position, bear on firmly, and make the strokes with a steady motion from left to right, using the side of the crayon.

Oblique Strokes. — In drawing from the upper right to the lower left, stand a little to the left of the drawing. In drawing from the upper left to the lower right, stand to the right of the drawing. Draw with a steady, even motion, secured by a firm pressure of the chalk upon the board.

The above exercises can be immediately applied in the following simple objects, represented by *combinations of straight lines:* —

The Brick Wall. — This is but a series of horizontal marks of the same size, each representing a brick. Use the side of the chalk for the width of the brick, and draw the stroke for its length in proportion. Draw a few irregular lines to represent a vine growing on the wall, and some suggestive marks about an inch in length and of irregular shape for leaves. The grass at the foot of the wall is drawn with the side of the chalk by apparently careless lines, generally in an oblique direction. For drawing leaves and grasses no definite directions can be given. Study the illustration for further aid.

The Well. — Draw three broad parallel horizontal strokes quite near each other, to represent the boards, then two narrow vertical strokes at the ends of the horizontal ones. Draw the chain or rope by a simple, straight vertical line of proportionate length; mark its fastening to the well-sweep; then draw the upright support with the side of a shorter piece of crayon, breaking the stroke in its course by different pressures. Draw some irregular marks, suggestive of weeds and grasses, as indicated in the illustration. Study the illustration for handling and simplicity of treatment; try to produce similar effects, and especially avoid overworking the drawing.

The Ladder. — The wall against which it leans should be drawn first. The two upright sides of the ladder are next drawn with a crayon of proper length

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to produce a mark of the desired width. The cross rounds or steps should each be drawn at one stroke, and narrower than the side pieces. Imagine a branch of a tree bending downward, and sketch broken oblique lines for the branch and twigs. Draw marks as before directed, to give the appearance of leaves. It is not necessary to follow the illustrations closely, for the object is to obtain facility in handling the crayon, the illustrations being for practice only. Do not attempt to copy much detail.

The Fence.—Draw in succession a series of parallel vertical strokes of the same width and length; then add the two horizontal strokes for the rails, to which the slats are fastened. If the slats have pointed ends, draw the triangular end with the side of the chalk, at one stroke, beginning at the point.

The Dog Kennel. — This drawing requires an even balance from the center of the roof. The angle representing the end of the roof is drawn first, then the vertical strokes to represent the boards, and then the horizontal stroke for the base or platform. All the vertical strokes are drawn in succession to the same ground level, and the arched space for the entrance is made by erasing as much of the drawing as is necessary.

The Gate. — Draw all the vertical strokes to represent the slats; then draw the upper and lower horizontal strokes for the rails, then the oblique brace. Draw one more broad vertical stroke to represent the side of the fence to which it is fastened.

EXERCISES ON CURVED LINES.

(See Illustrations, Plate II.)

The Circle. — The simplest curves are arcs of the circle. For freedom in executing the circle the following directions are given: Stand at a moderate distance from the board — at arm's length away from it is best for some drawings, which position also allows the pupils to see the work; stand firmly on both feet, poise the body properly, stretch the arm out directly towards the board at about the level of the shoulder, and let this point be the center of the circle to be drawn. From this position, move the arm to the left, to the right, above and below, as far as it will conveniently reach. Having thus determined the trace of the circle to be drawn, rotate the arm from left to right with a slow even motion, gradually increasing the speed of the rotation but keeping it regular. Finally, without breaking the continued motion, let the chalk trace the circle. This method of drawing a circle is almost purely mechanical, and will be found to give truer results and to take less time than any other.

The Ellipse. — Draw a circle by the method previously described and continue the motion, gradually lessening or flattening the curve on two opposite sides. These curves, if drawn with a free motion, will be good elliptical curves, having more feeling in their outlines than those drawn on axes. See Illustrations.

The Sphere. — The circle is the basis of all spherical forms. Draw the circular outline, using the side of the chalk. Draw the area of high light with

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broad parallel strokes, gradually diminishing the pressure, so that the tone naturally loses itself in that of the blackboard. Draw the reflected light directly opposite the high light. The clouds are drawn with the same circular motion, sometimes conflicting with and hiding parts of outlines already drawn. More natural effects may be produced when the chalk is handled lightly throughout, with only an emphatic stroke here and there for high light.

The Tomato. — This is based on the flat spheroid, outline for which is an ellipse. Draw this and then the outline of the segment. Press evenly and regularly with the side of the chalk, for the effect of light and high light on the left side. Draw the calyx with a single irregular mark for each sepal. Add the stem.

The Watermelon. — This may be represented by a series of ellipses. It should be practiced on the blackboard full size. Draw the outer ellipse first, then narrower ones to represent the markings. Represent the stem by one emphatic stroke with the side of the chalk.

The Apple, etc. — Small spherical forms are drawn by producing both outline and shaded surface by one stroke with the side of the chalk.

The Jardinière. — Draw a large ellipse to represent the entire contour of the jardinière. On its upper outline, draw a smaller ellipse for the mouth. The flutings are broad and rounded above, tapering toward the base; each may be made by one heavy stroke, gradually diminishing the pressure towards the tapering end. The flutings should appear to lessen in width to the left and right.

Arcs of Circles, applied in the drawing of *ferns* and *leaves.* Draw a circle with a free arm movement, and, beginning at any point within the circle and near its circumference, draw a set of connected arcs (as seen in the illustrations), with a forward and backward movement, without lifting the chalk from the board, gradually decreasing the length of the strokes towards the center of the circle. Practice these connected arcs in various positions.

The Clump of Ferns. — These are drawn with the same free backward and forward motion with the side of the chalk, the forward strokes being more emphatic than the return strokes. Begin with the base of the fern, gradually shortening the strokes towards the apex. To give effects of light, press more heavily at the beginning of each stroke. The grouping of the whole and the position of each fern must be studied from nature. A few lines representing grasses may be added.

The Palm Tree. — Draw the trunk of the tree with the side of the chalk, making a broken, uneven stroke to represent the rough appearance left by the persistent bases of the leaf-stalks. The leaves of the palm are usually many cleft, and to represent them use the same stroke as that for ferns. In drawing the crown of the tree, turn some of the leaves from us, some toward us, some to the left, and others to the right. Draw those turned from us indistinctly, and those in front with clearness. Connect the palms with the ground line by herbs and grasses.

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THE SPHERE AND OBJECTS SHAPED LIKE THE SPHERE.

(See Illustrations, Plate III.)

NOTE. — The sketches on the Plates III. and IV., and the upper half of Plate V. are to accompany the lessons in Pictorial Drawing upon the geometric type solids, and may be either drawn on the blackboard by the children previous to the lessons, or rapidly sketched by the teacher at the beginning of the lessons, when objects that resemble the geometric type solids are mentioned. The objects also should be present, so that the pupils will not fail to understand that the geometric type solids form the basis of, and their drawing aids in the representation of, all objects.

The Sphere. — Draw the outline with a circular motion, using the side of the chalk. Study the model to determine the areas of light and high light. Show the light area by a few somewhat irregular strokes, and represent the high light as previously directed on page 87. Draw the reflected light on the side opposite the high light, the tone passing gradually into the shade, represented by the blackboard. Draw with the side of the chalk over any transitions that are too abrupt or sudden.

The Cantaloupe. — Represent the entire spherical contour by a circle. Draw each of the segments with one stroke of the side of the chalk, covering the whole width of the division, pressing heavily at first and decreasing the pressure towards the lower part. Add the stem by one mark of uneven pressure with the side of the chalk.

The Apple. — Represent the general contour by a circle. Study the specimen and modify the circle accordingly. Make a few strokes to represent stripes and other markings. Add the light, as in the illustration. Draw the stem and the twig each with one stroke.

The Orange. — Make the contour a somewhat irregular circle and tint the light side faintly, the rough texture of the blackboard representing the porous skin. The folds in the skin at the stem end should be indicated by a few irregular lines drawn with the end of the crayon. The line at the back of the orange, representing the farther outline of the shelf or table, should be drawn less distinctly than the orange.

The Bunch of Grapes. — Study a specimen. Represent the twig by a mark with the side of the chalk and a few other lines, and the tendril by a single line. The leaf is an irregular little shape, slightly tinted, with a few marks to represent veins. The stems are represented by short, broken lines. Pass the side of the chalk lightly over the surface occupied by the bunch of grapes, producing an even, flat tone; then, with the side of a piece of chalk about an inch in length, draw each of the grapes. Those towards us show very nearly their entire contour; those to the left and right are partly hidden. The left ones may be drawn quite white, and the right ones obscure gray. Add a point of high light to the prominent grapes, and a little reflected light to each.

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The Blackberry. — This illustration, with the exception of the sepals of the calyx, is drawn in outline, and no directions need be given.

The Cherry. — Draw the line of the stem, and then the fruit balanced properly on the stem. Light up the left upper half.

The Horse-chestnut. — Draw a circular curve with the side of the chalk to represent the left or further half of the horse-chestnut, then a complete circle for the near half, the latter partly covering the left side, and marking the division of the cells. The prickles on the receding surface show in profile, and are drawn with short, accented lines; those toward us are foreshortened, and should be drawn with shorter lines or dots according to their position.

The Twine-holder, Glass Globe, Basket, and **Chinese Doll's Head** can be studied with the illustrations of spherical objects, but they are only suggestions; any other simple objects may be used in their place.

The Globe. — Draw a circle of large size representing the earth; an oblique diameter at an angle of $23\frac{1}{2}^{\circ}$ for the earth's axis; a diameter at right angles to the first for the equator. Draw simple curves at proportionate distances from the poles for the Arctic and Antarctic circles, and curves to represent the Tropics of Cancer and Capricorn. Beginning at the left of the axis, draw simple curves for meridians, gradually lessening the space between them to give a spherical effect. Repeat the same at the right of the axis. This exercise should also be practiced by the pupils and may be made useful in outline map-drawing.

OBJECTS BASED ON THE ELLIPSOID, FLAT SPHEROID, AND OVOID.

(See Illustrations, Plates IV. and V.)

The Bunch of Grapes. — Study a bunch of grapes and note the shape of the whole, the slender stems, the growth of the berries on the stem, and the form of the berries. Begin by drawing an even light tone with the side of the chalk, indicating the shape of the bunch; then with the side of a short piece of chalk draw the berries. Those on the upper end of the bunch may be more pronounced than the others; those that are nearer hide parts of the contour of the others. High light may be put upon all the prominent grapes.

The Potato. — Choose a large, rough specimen for study, and represent its outline by a somewhat broken elliptical line. Represent the area of light. Study the position of the sprouts and represent them by short emphatic marks.

The Plums. — Draw first the twig and the node from which the plum stems grow. Then draw the stems according to their position. Sketch the ellipses representing the plums with the side of the chalk. Try and produce at once the effect of high light on the plum.

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The Lemon. — Draw a somewhat irregular ellipse, varying according to the specimen. Represent the ends as they are in the specimen.

The Watermelon. — This is one of the most satisfactory examples of ellipsoidal forms, and may be sketched with much freedom; the marks representing its varied color must be drawn with the side of the chalk.

The Bonbon Box. — Draw freely the elliptical outline and the strokes for the staves of the little barrel. Make the motions for drawing the horizontal ellipses to represent the bands, but draw the visible half only. Give a little finish to the ends of the box, and draw the cord by which it may be carried.

The Cucumber, Walnut, Lantern, Vase, Tureen, and **Shell,** are all appropriate objects for illustrating the lesson on the ellipsoid; the method for drawing them is substantially the same as that for any of the ellipsoidal forms.

The Flat Spheroid. — The outline drawing of the flat spheroid is a horizontal ellipse, the high light being on the upper half. The distribution of light may be quite general, with a very faint effect of reflected light.

The Tomato. — The drawing of the tomato has already been described on page 87 under Exercises on Curved Lines.

The Sea Urchin. — Draw the ellipse representing its contour, then the segments in light lines; half-tint the upper left side, and represent the bases of the spines by rows of dots.

The Ovoid. — Draw an oval resting on its side, and give the effect of light to its upper left area.

Eggs in the Nest. — Draw the eggs in various positions, each with one stroke. Soften the surface by gently rubbing the chalk from the light to the dark side. Draw irregular broken lines to represent straw.

Sea Egg (*Spatangus*). — Since the object is white and comparatively smooth, sketch the outline heavily with the side of the chalk. Mark the radial zones or ambulacra lightly. In the illustration four petals show clearly; the fifth is undeveloped.

PLANT, ANIMAL, AND GEOGRAPHY LESSONS.

The remaining illustrations, on Plates V. and VI., will suggest how blackboard illustrative sketching may be utilized in animal, plant, and geography lessons. The sketches given are to illustrate lessons on the ostrich; on mountains and the formation of rivers; on the seacoast, cape, promontory, island, etc.; on the palm tree and desert. They are sufficient to show the method of treatment, and are probably as difficult as any that need be used. By the expenditure of a little time and effort in this direction, the teacher will find that lessons on natural subjects can easily be impressed and made very interesting to the pupils.

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PLATE I.

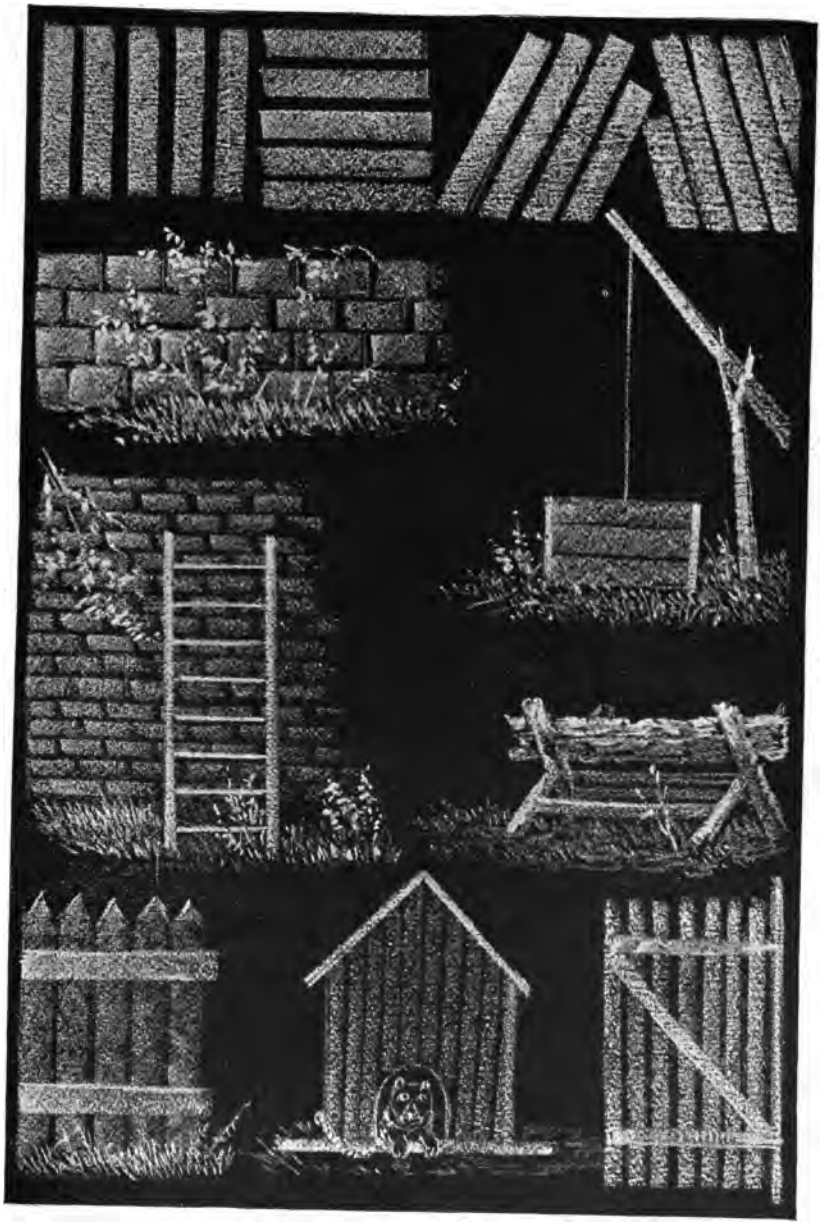

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PLATE II.

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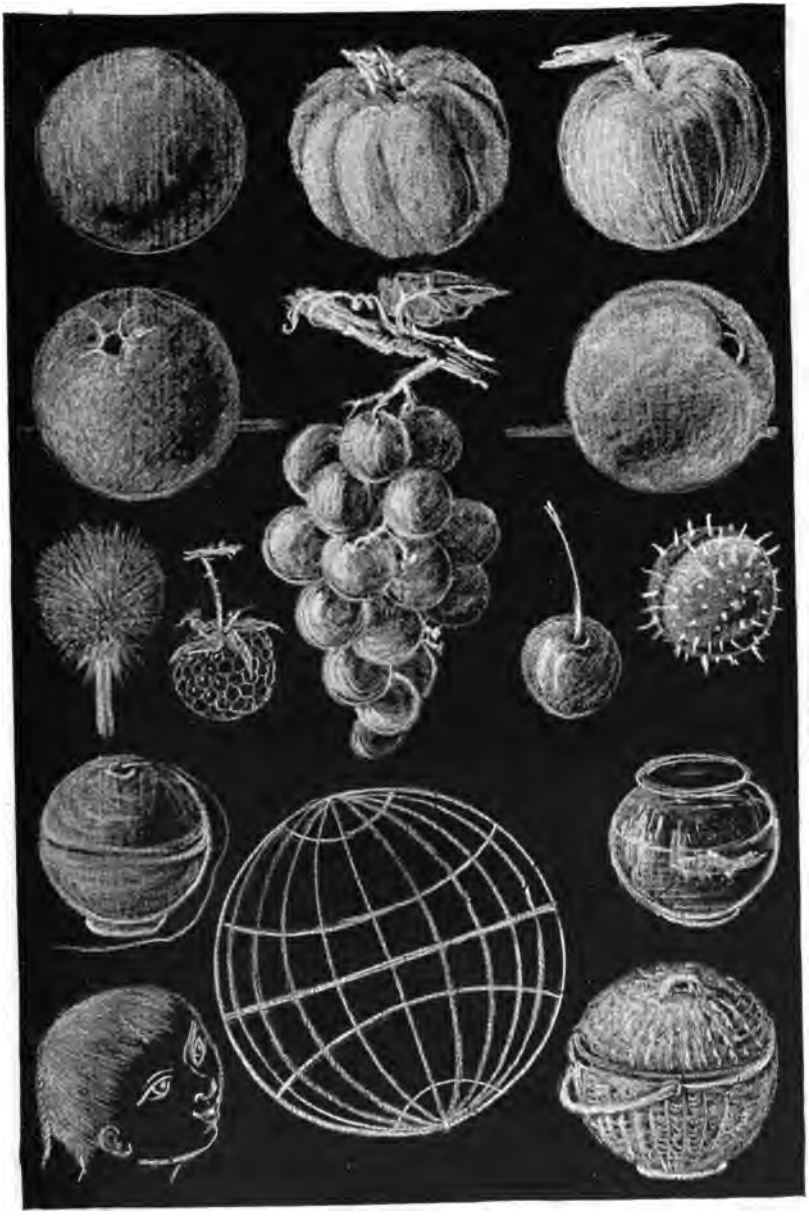
PLATE III.



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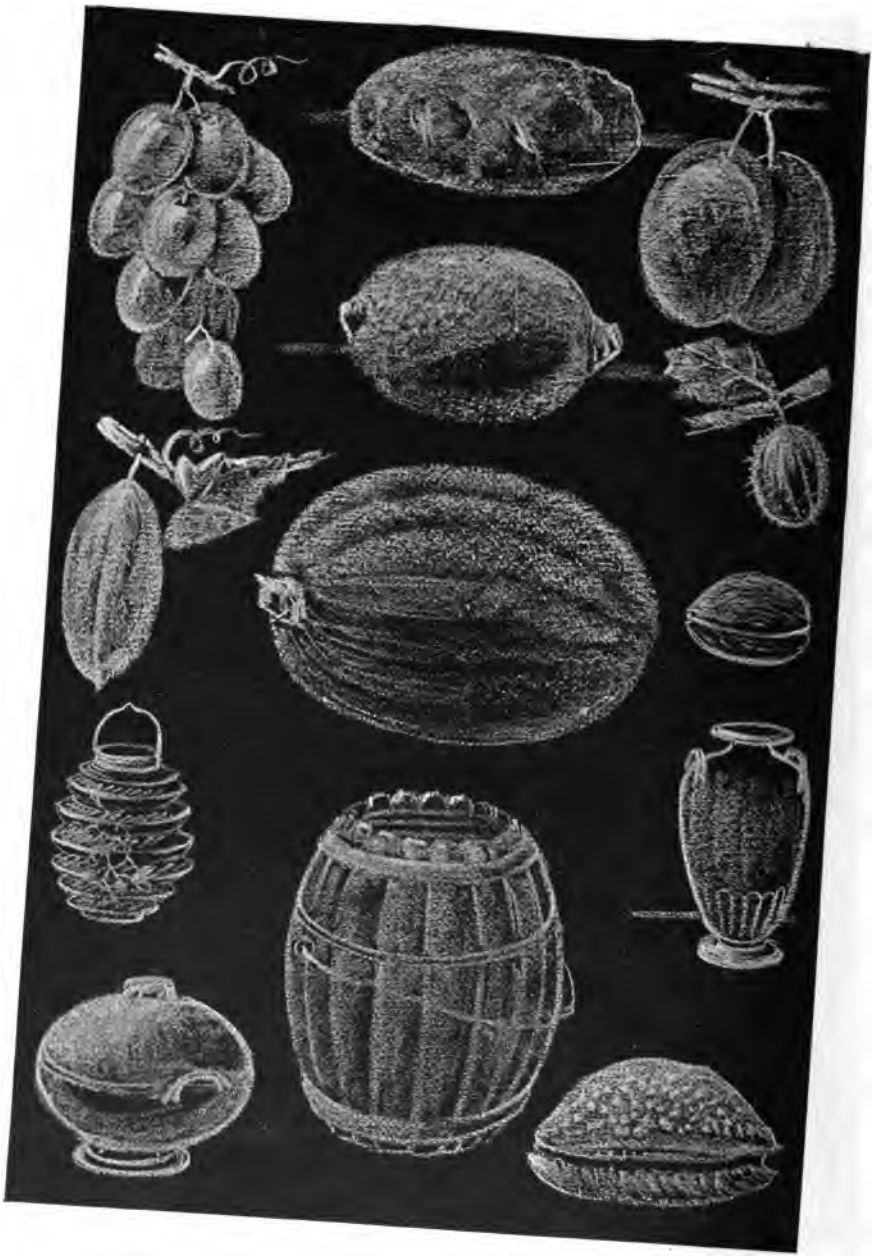

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PLATE V.

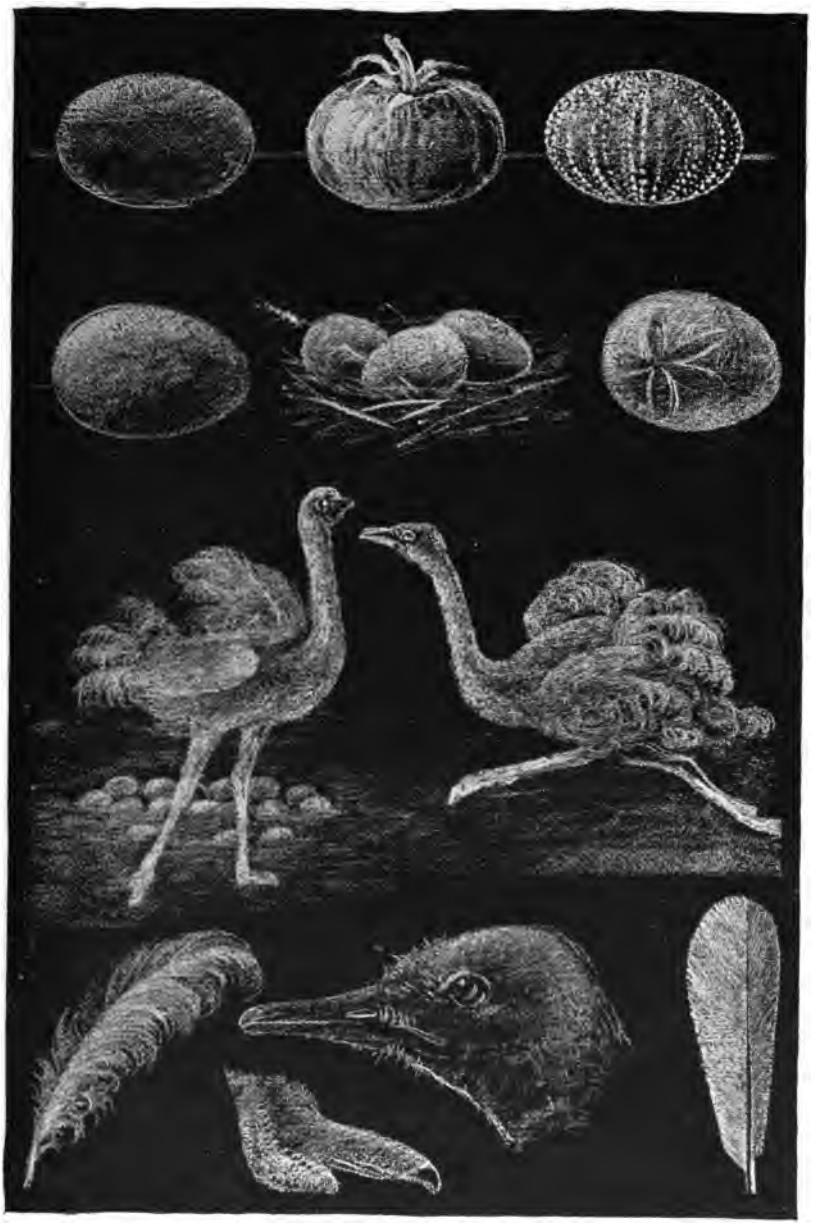

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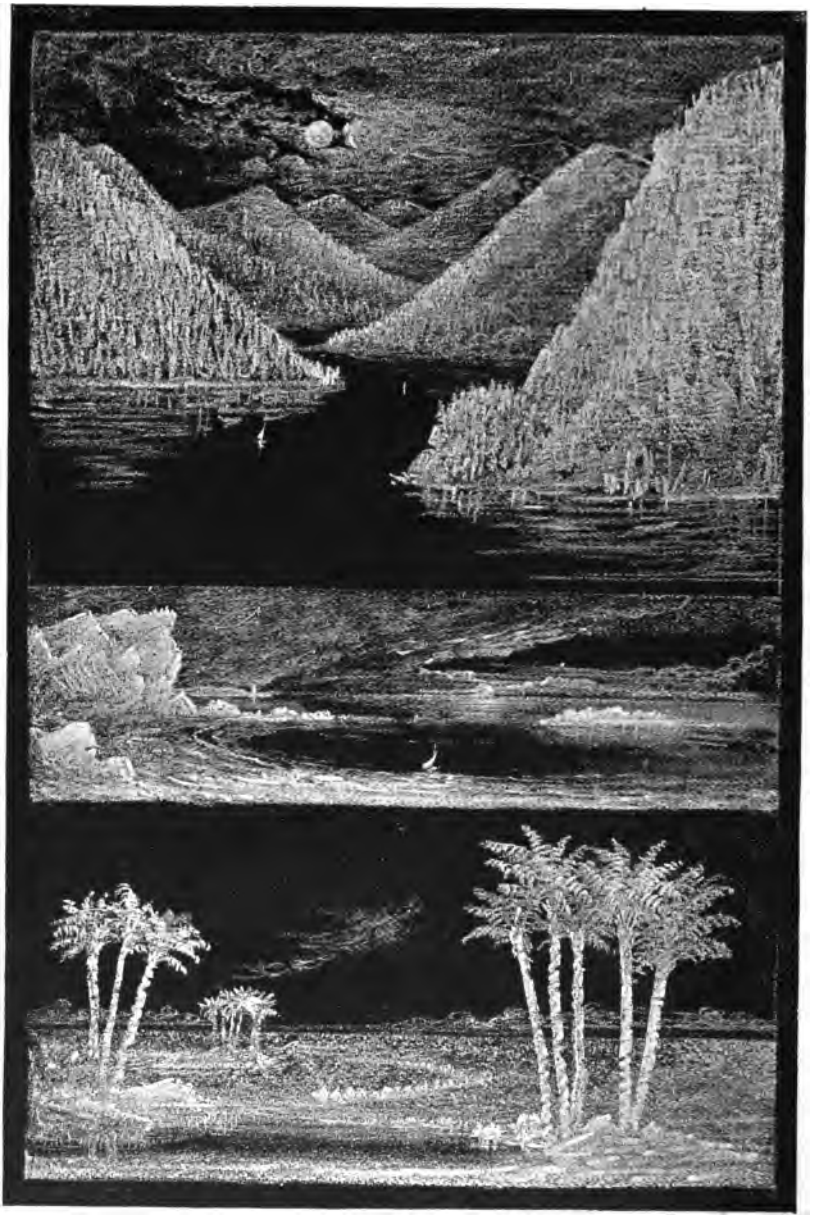
PLATE VI.



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ILLUSTRATED DEFINITIONS.

GEOMETRIC SOLIDS.

A Solid is space inclosed by surfaces — it has length, breadth, and thickness. In art, the term may be applied either to a model or an object.

Sphere. A solid bounded by one curved surface, every part of which is equidistant from its center. A solid formed by the revolution of a circle upon its diameter.

Hemisphere. Half a sphere. A solid obtained by bisecting a sphere with a plane passing through the center.

Spheroid. A curvilinear solid bounded by one curved surface, all plane sections of which are ellipses or circles.

Prolate Spheroid, Long Spheroid, or **Ellipsoid.** A curvilinear solid, formed by the revolution of an ellipse upon its major axis.

Oblate Spheroid or **Flat Spheroid.** A curvilinear solid formed by the revolution of an ellipse upon its minor axis.

Ovoid. A solid having the form of an egg. A solid formed by the revolution of an oval upon its axis.

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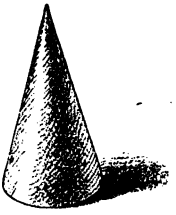
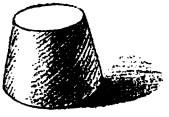
Cylinder. A roller-like body, with flat, circular ends. A solid formed by the revolution of a rectangle upon one of its diameters.

Half-cylinder. A solid formed by dividing a cylinder with a plane passing through its axis.

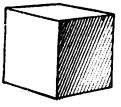
Circular Plinth. A very short cylinder. A cylinder in which the height is less than the diameter of its flat, circular faces.



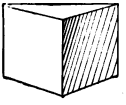
Cone. A solid having a circle for its base, and tapering to a point, or vertex. A solid formed by the revolution of an isosceles triangle upon its altitude.



Circular Frustum. That part of a cone which remains when the top part is cut off by a plane parallel with its base.



Cube. A solid bounded by six equal square faces.



Half-cube. A solid formed by dividing a cube upon a diagonal of one face. A half-cube is a triangular prism.

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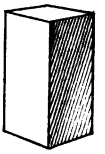
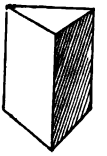


Prism. A solid whose ends are similar, equal, and parallel, and whose sides are parallelograms.

Square Prism. A prism whose ends are square.

Square Plinth. A very short square prism. A plinth in which the height is less than the diameter of the square faces.

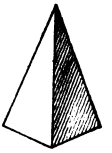


Triangular Prism. A prism whose ends are triangles.

Pentagonal Prism. A prism whose ends are pentagons.

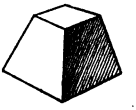
Hexagonal Prism. A prism whose ends are hexagons.

Octagonal Prism. A prism whose ends are octagons.



Pyramid. A solid having one base bounded by any number of straight lines, and having the same number of triangular faces with a common vertex.

Square Pyramid. A pyramid whose base is a square.



Square Frustum. That part of a square pyramid which remains, when the top part is cut off by a plane parallel with its base.

Triangular Pyramid. A pyramid whose base is a triangle.

Pentagonal Pyramid. A pyramid whose base is a pentagon.

Hexagonal Pyramid. A pyramid whose base is a hexagon.

Octagonal Pyramid. A pyramid whose base is an octagon.

Truncated Solid. That part of a cylinder, cone, prism, or pyramid, which remains, when the upper part is cut off by a plane at an oblique angle with the base.

DETAILS OF SOLIDS.

Surface is the boundary of a solid; it has length and breadth, but no thickness. In art, the outside of a thing is considered its surface.

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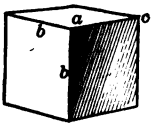
Face. A part of a solid (*a*) bounded by edges.

Edge. A part of a solid, where the surface abruptly changes its direction (*bb*). A part of a solid where two faces meet.

Outline. The line, real or apparent, by which a figure is defined.



Corner. A part of a solid (*c*), where three or more edges meet.

Point. A point has position only, without size; but in drawing it is indicated by a dot, and represents a corner, or marks position.

Line. The boundary of a face. A line has length only; but in drawing it is indicated by a fine mark of the pencil or crayon, and represents an edge or an outline.

Straight Line. A line which has the same direction throughout its length.

Curved Line. A line which constantly changes its direction throughout its length.

Broken Line. A line made up of very short straight lines or of dots.

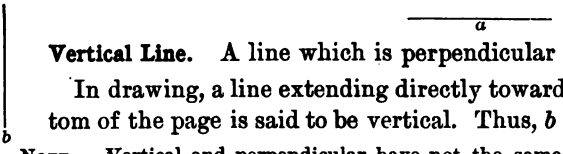
NOTE. — When the word "line" is used alone, a straight line is meant.

Positions of Lines.

According to their positions, lines are *horizontal*, *vertical*, or *oblique*.

Horizontal Line. A line which is level.

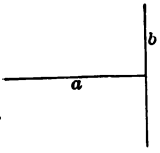
In drawing, a line which extends directly toward the right and left of the page is said to be horizontal. Thus, *a* is a horizontal line.



Vertical Line. A line which is perpendicular to a horizontal.

In drawing, a line extending directly toward the top and bottom of the page is said to be vertical. Thus, *b* is a vertical line.

NOTE. — Vertical and perpendicular have not the same meaning. A *vertical* line always points up and down; but any line forming a right angle with another is *perpendicular* to that line, no matter what its direction may be. Thus, *a* is *perpendicular* to *b*, although not a *vertical* line.



Oblique Line. A line which is slanting to the right or left. Thus, *c* and *d* are oblique lines. If the upper end of the line leans toward the right, it is called a *right-oblique* line, as *d*; if toward the left, a *left-oblique* line, as *c*.

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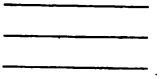
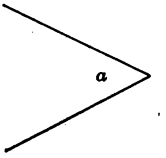
Relation of Lines.

In their relation to each other, lines may be *parallel* or *at an angle.*



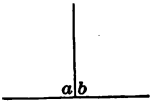
Parallel Lines. Two or more lines that are the same distance apart throughout their length.

Lines at an Angle. Lines that are not parallel.



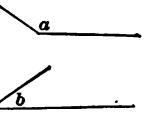
Angle. The difference in direction of two lines, which meet at a point, is called an angle. Thus, *a* is an angle.

Angles are divided according to the directions of their lines into *Right Angles* and *Oblique Angles.*



Right Angle. An angle formed by one line meeting another in such a way as to make the two adjacent angles equal. Thus, *a* and *b* are right angles. The lines forming these angles are *perpendicular.* (See note under "Vertical Line.")

Oblique Angles. All angles which are not right angles are oblique. Oblique angles are either *obtuse* or *acute.*



Obtuse Angle. An angle that is greater than a right angle. Thus, *a* is an obtuse angle.

Acute Angle. An angle that is less than a right angle. Thus, *b* is an acute angle.

NOTE. — The lines forming an angle are called its *sides;* the point at which they meet is called the *vertex* of the angle.

GEOMETRIC FIGURES.

Plane. A surface on any part of which a straight line may be drawn in any direction.

NOTE. — The top of the desk, if it can be imagined without thickness, may illustrate a plane.

Geometric or **Plane Figure.** A portion of a plane limited by lines.

Rectilinear Figure. A portion of a plane limited by straight lines.

Curvilinear Figure. A portion of a plane limited by curved lines.

Mixtilinear Figure. A portion of a plane limited by both straight and curved lines.

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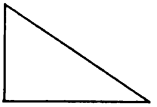
RECTILINEAR PLANE FIGURES.

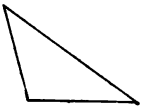
Triangles.

A Triangle is a plane figure having three sides and three angles.

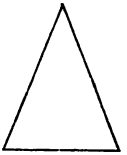
Triangles are divided into six classes: according to their angles, into *Right-angled*, *Obtuse-angled*, and *Acute-angled* Triangles; according to the relative lengths of their sides, into *Isosceles*, *Equilateral*, and *Scalene* Triangles.



Right-angled Triangle. A triangle having one right angle.



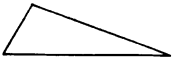
Obtuse-angled Triangle. A triangle having one obtuse angle.



Acute-angled Triangle. A triangle having all its angles acute.

Isosceles Triangle. A triangle having two of its sides equal.

Equilateral Triangle. A triangle having all its sides equal.



Scalene Triangle. A triangle having no two of its sides equal.

NOTE. — Every triangle may have two names — one given it on account of its sides, the other on account of its angles. For example, an equilateral triangle is also an acute-angled triangle, for having three equal sides always gives it three acute angles.

Quadrilaterals.

Quadrilateral. A plane figure having four sides.

Rectangle. A quadrilateral whose angles are all right angles.

Rectangles are divided into *squares* and *oblongs*.

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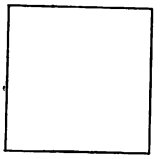
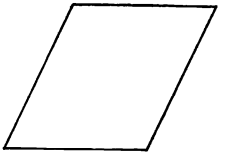
Square. A rectangle whose sides are equal.

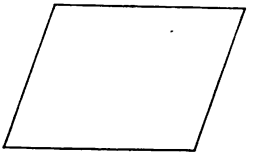


Oblong. A rectangle whose adjacent sides are unequal.

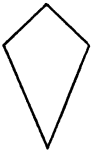
Rhombus. A quadrilateral whose sides are equal, two of its opposite angles being acute, and the other two obtuse. A *Diamond* is a rhombus.



Rhomboid. A quadrilateral whose angles are like those of a Rhombus, but only its opposite sides are equal.



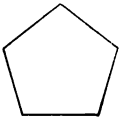
Trapezium. A quadrilateral no two of whose sides are parallel.



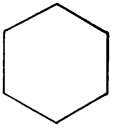
Polygons.

A Polygon is a rectilinear figure having more than four sides. When all the sides and angles of a polygon are equal, it is called a *regular polygon;* when the sides or angles are unequal, it is called an *irregular polygon.* Geometrically, triangles and quadrilaterals are frequently classed as polygons.

Regular Pentagon. A polygon having five equal sides and five equal angles.



Regular Hexagon. A polygon having six equal sides and six equal angles.



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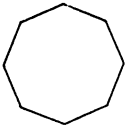
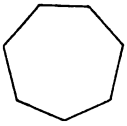
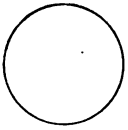


Regular Octagon. A polygon having eight equal sides and eight equal angles.



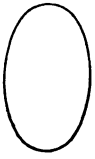
A polygon having seven sides is called a **Heptagon.**
A polygon having nine sides is called a **Nonagon.**
A polygon having ten sides is called a **Decagon.**
A polygon having eleven sides is called a **Undecagon.**
A polygon having twelve sides is called a **Dodecagon.**

CURVILINEAR PLANE FIGURES.



Circle. A plane figure bounded by a curved line, every part of which is equally distant from a point within called the center.

A *semicircle* is half a circle, and is obtained by cutting a circle on its diameter. It is a *mixtilinear* figure.



Ellipse. A plane figure, bounded by a regular curve, every point in the outline of which is at the same combined distance from the foci.

Oval. A plane figure similar in shape to the longitudinal section of a hen's egg.

Crescent. A plane figure bounded by two curved lines, so arranged as to resemble the shape of the new moon.

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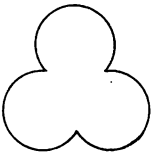
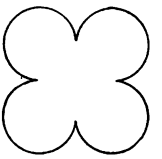
Lens. A symmetrical plane figure bounded by two curved lines, curving in opposite directions.

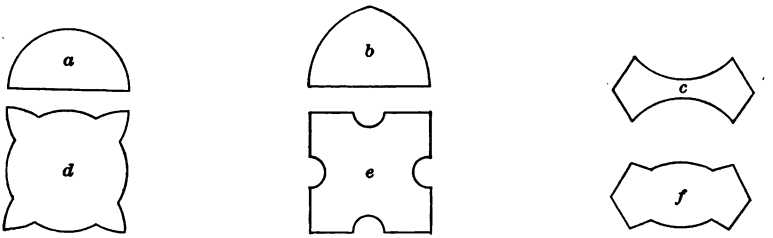
Trefoil. An ornamental figure of three foils or leaves, resembling a clover leaf.



Quatrefoil. An ornamental figure of four foils or leaves, resembling the petals of a flower.



MIXTILINEAR PLANE FIGURES.



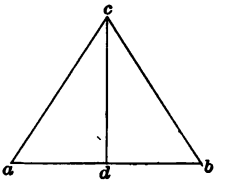
Of these there are, of course, an infinite number. They are used in art largely as inclosing forms for designs. The foregoing figures (*a*, *b*, *c*, *d*, *e*, *f*) illustrate these.

DETAILS OF GEOMETRIC FIGURES.

Base. That part of a rectilinear figure upon which it is supposed to rest, as *ab*.

Apex. The highest angle above the base, as *c*.

Altitude. The perpendicular distance from apex to base, as *cd*.



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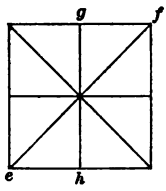


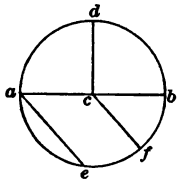
Axis. Any line which divides a symmetrical figure into two equal and similar parts, as *ef* or *gh*.

Diagonal. A line connecting opposite angles, as *ef*.

Diameter. A line connecting the centers of opposite sides, of a plane figure, as *gh*.

Diameters are sometimes distinguished as *vertical* and *horizontal*.

Diameter of a Circle. A line drawn through its center, between opposite points in the circumference, as *ab*.



Radius of a Circle. The distance from the center of a circle to any point in the circumference, as *cd*.

Circumference. The unbroken line which bounds a curvilinear figure.

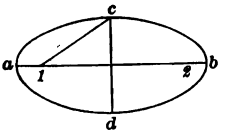
Arc. Any part of a curve, as *db* or *ef*.

Chord. A straight line connecting the extremities of an arc, as *ae*.

Segment. The space inclosed by an arc and its chord.

Sector. The space between any part of the circumference and two radii of a circle, as *bcf*.

Quadrant. The space inclosed by one quarter of the circumference and two radii of the circle, as *dcb*.

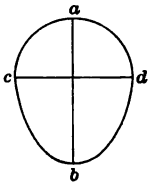


Long Diameter. The longest straight line which can be drawn in an ellipse, as *ab*.

Short Diameter. The shortest straight line which can be drawn in an ellipse, cutting the figure into two equal parts, as *cd*.

The long and short diameters of an ellipse are always perpendicular, and bisect mutually.

The terms *long* and *short diameter* are sometimes applied to the axis and the line representing the greatest width in an oval; as, long diameter *ab*, short diameter *cd*.



Foci. Points in an ellipse from which the curve may be drawn mechanically, as *1*, *2*. The distance from *c* to *1* always equals one half of *ab*.

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MISCELLANEOUS TERMS.

Alternation. The repetition of one set of units separated by another set of units of a different character, in reciprocal succession.

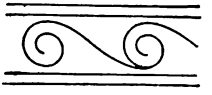
Axis of Symmetry. A line drawn through the middle of a figure, so that the parts on one side are exactly repeated in a reverse order on the other. The axis may be drawn in any direction, being governed by the character of the figure; in the ornamental figure next below, it is vertical.

Bisect. To divide into two equal parts. ——|——

Bisymmetrical Design. A symmetrical arrangement in which one half is the exact reverse of the other.

Blocking-in Lines. Sketched lines which indicate masses.

Border. An ornament which consists of a regular repetition of ornamental units, along a line of indefinite length. The cut shows a familiar Greek border, composed of scrolls or spirals.



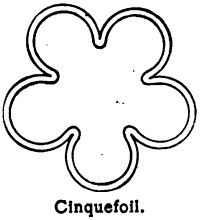
Botanical Drawing. The representation of plant form.

Center. A radial design.

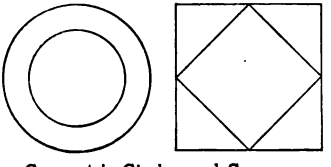
Center Line. A line representing the center of a solid.

Cinquefoil. An ornamental figure having five foils or lobes, often applied in windows, panels, etc.

Circle. In Christian art, a symbol of eternity.



Cinquefoil.



Concentric Circles and Squares

Concentric. Having a common center.

Connecting Line. A line connecting similar parts in the drawings of two views of an object.

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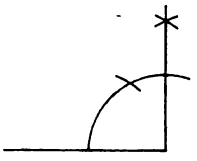
Construction. Making, or building; putting together the parts of any figure so as to give its peculiar form and structure. *Construction lines* are the framework upon which a drawing is made; they determine the distances, proportions, etc. *Construction*, as applied in geometrical problems, refers to the measurements and steps taken in the solution of the problems. The light lines in the cut show a method of construction in erecting a perpendicular at the end of a given line.

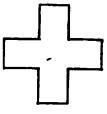


Contrast. The result of a juxtaposition of lines, forms, or colors of different characters.

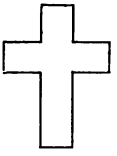
Contrasted Harmony. (See "Harmony of Color.")

Conventionalization. The modifying of natural forms in such a way that the principles of their growth are retained and unimportant details omitted or simplified. A conventional form is a form idealized according to the evident intent of nature.

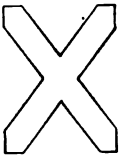
Cordate. Resembling a heart in outline.



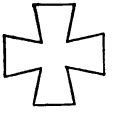
Greek Cross.



Latin Cross.

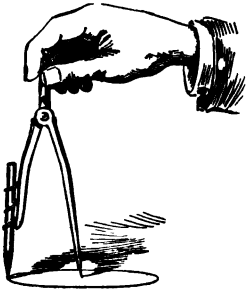


St. Andrew's Cross.



Maltese Cross.

Cross. Two bars placed transversely upon each other in various ways, each form having its own name. A symbol of suffering. Some of the more common crosses are shown in the illustrations.



Dashed Line. A series of dashes arranged in line. Invisible parts of objects are represented by dashed lines.

Describe a Circle. To draw with a compass. The accompanying cut shows the position of the hand, while describing a circle with the compass.

Design. The plan, combination, or arrangement of any construction or ornament for a given purpose, whether constructive

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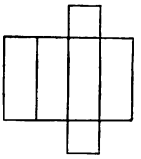
or decorative. The word is often misused to apply merely to ornamental subjects.

Detail. A selected part of a figure or object, usually drawn on a larger scale than is convenient for the whole.

Develop. To represent on a plane the entire surface of a figure.



Development. The entire *surface* of any solid or object when laid out upon one plane, as in the cut, which shows the development of a square prism. (See "Flat.")

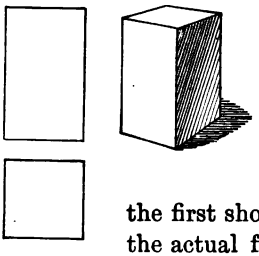
Diaper. A panel or flat, recessed surface covered with wrought work in low relief. (This form of decoration was used greatly by the Moorish artists for the enrichment of the walls of the Alhambra.) An all-over pattern.

Distribution. An orderly disposition of the units in the field of a design.

Dot-and-dash Line. A series of dots and dashes alternated in line. Center lines are drawn with dot-and-dash lines.

Dotted Line. A series of dots, or very short dashes, arranged in line. Connecting lines are drawn as dotted lines.

Elementary Design. A pleasing arrangement of units within a given form, based on certain recognized principles.



Elevation. A drawing giving the actual form and proportions of an object, as produced on one or more vertical planes. *Elevation* is opposed to *Plan*, which gives the actual form and proportion of an object as produced on a horizontal plane. Thus, in the three figures given the first shows the appearance of a prism, the *plan* shows the actual form and proportion of the base of the prism, and the *elevation* gives the form and proportion of one of the sides of the prism. Some objects require several different elevations, to show all the facts of form of all their details.

Field. That portion of any surface to be occupied by a design.

Flat. A development of the *whole* of an object; *e.g.*, the *flat* of a paper windmill is like a square with its diagonals.

Flat Ornament. An enrichment of a surface by means of contrast obtained by colors, or the use of light and dark.

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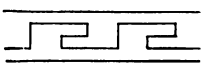
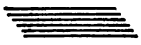
Fret. An ornament consisting of a series of lines or bands called *fillets*, which form a succession of angles, usually right angles, and are sometimes interlaced.



Full Line. A continuous line. Outlines and visible edges are always drawn with full lines.

Geometric Drawing. The drawing of lines, surfaces, and solids with instruments.

Ground. That upon which the object rests. The field of a design.



Half-tint. The darkening or shading of a surface, by means of a succession of parallel and equidistant lines, either vertical, horizontal, or oblique.

Harmony. Such an adaptation of the parts of a design to each other, that they form a complete and pleasing whole.

Harmony of Color. An arrangement of colors pleasing to a cultivated taste. There are five principal Harmonies: —

1. **Contrasted.** Composed of one color with neutrals.
2. **Dominant.** Composed of tones of color in one scale.
3. **Analogous.** Composed of colors from neighboring scales.
4. **Complementary.** Composed of colors which, when mingled, will produce white or gray.
5. **Perfected.** Usually composed of analogous or dominant combinations, with another color complementary to the prevailing tone.

Neutral colors may be added to all these combinations.

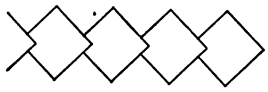
Hue. Any color found in the spectrum, except the six standard colors.

Mass. General shape, regardless of detail.

Neutral Color. A term used in decorative arts, to denote a color which has little or no effect upon the hue of a juxtaposed color. A neutral color is sometimes called a *passive color*.

The neutral colors are *white*, *gray*, and *black*.

Ornament. Any decoration or enrichment of form, color, or construction, intended to beautify an object.



Overlap.

Overlap. To lie over or upon. When a part of an ornament seems to lie upon another part, it is said to *overlap*.

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Perspective. The science underlying the representation on a plane of any object exactly as it *appears* to the eye from one fixed point of view. The first cut under "Elevation" is a drawing *in perspective* of the prism represented.

Pictorial Drawing. A representation of the appearance of an object or group, as seen from one point of view.

Plan. A top view. (See "Elevation.")

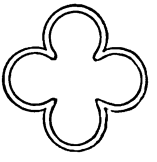
Plinth. A square member forming the lowest part of the base of a column; hence, any flat rectangular block, such as might be cut from a plank.

Proportional Measurement. A method of obtaining relative distances upon distant objects, by means of a pencil or similar implement.

Quadrisect. To divide into four equal parts.

Quality of a Color. The character of a color relatively considered. The quality of a color is said to be *warm*, when it approaches in appearance any of the colors in the red part of the spectrum; or *cold*, when it approaches in appearance any of the colors in the blue part of the spectrum. Colors acquire certain qualities by juxtaposition.

Quatrefoil. An ornament having four foils or lobes, often applied in panels, windows, etc. A symbol of the Evangelists.

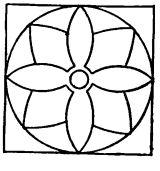


Quatrefoil.

Radiation. A method of arrangement in ornamental design, in which the parts diverge from a point. The *rosette* shown in the figure below is an example of radiation from a center. The horse-chestnut leaflets radiate from a point not in the center.

Repetition. An arrangement in which a number of similar forms or objects are placed in a row, or arranged round a center or over a surface.

Representation. Delineation by means of lines, light and shade, or color. All drawing is representation.



Rhythm. Repetition with accent. The frequent recurrence of some characteristic in the various parts of a design, without being obtrusive.

Rosette. A radiating ornament made of petal-like parts.

Scale of Color. The entire range of tones, from white, through its tints, a standard or hue, and its shades, to black.

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Spectrum. A band of colors, produced by allowing rays of sunlight to pass through a triangular prism of glass, or other refracting medium. The spectrum contains red, orange, yellow, green, blue, and violet, usually called the *standard*, or *primary*, colors, and an indeterminate number of intermediate hues.

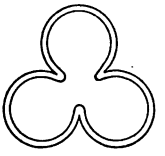
Standard Color. One of the six primary colors of the spectrum. A standard pigment color is one which imitates one of these, as closely as possible.

Symmetry. The result of a proper disposition and proportion of the parts of a design, forming a complete whole or unit.

Tangent. Touching at a single point. A line touching a curve which, even when produced, does not intersect it.

Tint. A color produced by adding light, or white, to a standard or hue.

Tone. One color in a scale of colors. Tone is also used to describe the general effect produced by any combination of colors.



Trefoil.

Trefoil. An ornament of three foils or lobes, often applied in panels, windows, etc. A symbol of the Trinity.

Trisect. To divide into three equal parts.

Unit of Design. One of the distinct fractions, or parts, of a design, repeated uniformly to complete the figure. One of the spirals in the design under "Border" is the *unit of design*, which, repeated, makes the completed figure shown.

Unity. Such a combination of parts as to constitute a complete and pleasing whole. The result of uniformity in the character of the main lines or units in a design.

Value. In color, the power or force of a color upon the eye. It is directly proportional to the amount of light the color reflects.

Variety. The result of variation, or difference, in the details of a design, without affecting its unity.

View. A term used to indicate the standpoint of the observer, when making a drawing of an object, as the *end view*, when only the end is seen.

Working Drawings. Drawings which represent facts of form; drawings from which objects may be accurately made or constructed. In making a working drawing, the eye is supposed to be opposite each part of the object represented.

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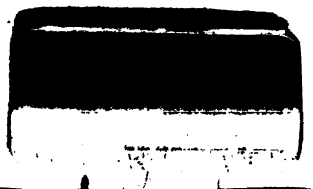

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